

Using This Retrofit Guide

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Specification sheets on Watlow product may be obtained at <http://www.watlow.com/literature/specsheets/>

User Manuals on Watlow product may be obtained at <http://www.watlow.com/literature/prodtechinfo/>

Additional information on other Watlow products may be obtained by visiting <http://www.watlow.com/>

To locate a controller, search on the part number such as 965A-1CD0-00RG. Use the Help feature in Adobe Reader on how to search documents.

If there are multiple listings, then the retrofit is conditional upon field use. Select the appropriate selection. The User's Manual is included at the bottom of this document when available.

Before selecting a replacement controller:

1. Know the application.
 - Temperature range
 - Sensor type
 - Is the sensor upgradable if required?
 - Additional input requirements – remote set points, secondary sensor or events
 - Output required – control, alarm, event
 - Is the power-switching device upgradable?
 - Operating voltage of controller
 - Mounting requirements – panel space
 - Is a safety limit device required?
2. Know the product.
 - Inputs – type and number of
 - Control function – direct (cool) or reverse (heat)
 - Outputs – switched DC, SSR, or mechanical relay
 - Communication requirements
 - Which control features are required? (cascade, slidewire, differential, remote control, other)
3. Use your best judgment for selecting a replacement controller. All applications require close examination of input, output and the control mode needs to have the controller function properly.
4. Safety: Remember to make sure all redundant safety equipment is in place and working when retrofitting equipment. If a system has been retrofitted without the proper safety equipment, you could be liable if an accident occurs.

This is only a guide to replacement controllers. If you have doubts, please call (507) 454-5300 and ask for technical support or email wintechsupport@watlow.com. We're here to help. The suggested replacement will differ in fit and form. Please review the replacement controller specifications for suitability. Carefully check the notes for additional information that may apply.

Your comments or suggestions on the Retrofit Guide are welcome. Please send comments or corrections to: Technical Writer, Watlow Controls, 1241 Bundy Boulevard, P.O. Box 5580, Winona, MN 55987-5580; phone (507) 454-5300; fax (507) 452-4507. This Retrofit Guide is copyrighted by Watlow Winona, Inc., © February 2004 with all rights reserved. (1455)

Abbreviation & Terminology

(as used in this document)

0.5 – 0.5 amperes of current switching capability

2A – 2 amperes of current switching capability

5A – 5 amperes of current switching capability

10A – 10 amperes of current switching capability

15A – 15 amperes of current switching capability

12-24 – Supply voltage can be between 12 to 24 Volts

100-240 – Supply voltage can be between 100 to 240 Volts

100 ohm DIN – refers to 100-ohm platinum RTD that has a DIN curve.

100 ohm JIS – refers to 100-ohm platinum RTD that has a JIS curve.

1/32 DIN – Deutsche Industrial Norm standard for panel mounted controller, hole size is cut to 1.78”w x 0.88”h.

1/16 DIN – Deutsche Industrial Norm standard for panel mounted controller, hole size is cut to 1.78”w x 1.77”h.

1/8V DIN – Deutsche Industrial Norm standard for panel mounted controller, hole size is cut to 1.78”w x 3.63”h.

1/8H DIN – Deutsche Industrial Norm standard for panel mounted controller, hole size is cut to 3.63”w x 1.77”h”

1/8S DIN – Deutsche Industrial Norm standard for panel mounted controller, hole size is cut to 2.68”w x 2.68”h.

¼ DIN – Deutsche Industrial Norm standard for panel mounted controller, hole size is cut to 3.63”w x 3.63”h.

Action – determines the direction of control. Heat (reverse acting) or Cool (direct acting).

Auto Reset – the limit will automatically reset on a power cycle but requires manual reset on limit trip.

Cascade – a control algorithm in which the output of one control loop provides a set point for another loop. The second loop, in turn, determines the control action.

Ch – Channel refers to an analog input. There are single and dual channel controllers.

Control Mode – the method that a controller uses to switch the outputs such as PID, ON/OFF, and Manual.

Differential - control algorithm in which the output is based on the difference of the inputs plus set point.

DIN – Deutsche Industrial Norm, a set of technical, scientific and dimensional standards developed in Germany. RTD sensors with the DIN curve change resistance at a rate of 0.00385 ohms/ohms/C.

DIN Rail – standard DIN EN50022 mounting method for attaching devices onto a metal rail.

Fixed – refers to a set point that is fixed at one value.

High Limit - device will deactivate output on a temperature rise above set point.

Inductive Load – any device that has a wire winding such as solenoids, electromechanical relays or transformers.

Input – refers to the sensor types that may be connected.

Integral – the set point in integral (on board) to the controller.

JIS – Joint Industrial Standards, a set of technical, scientific and dimensional standards developed in Japan. RTD sensors with the JIS curve change resistance at a rate of 0.00396 ohms/ohms/C.

Line Voltage – the voltage required powering the electronics of the controller.

Low Limit - device will deactivate output on a temperature drop below set point.

On/Off – a method of control that turns the output full on until set point is reached and then off until the process error exceeds the hysteresis.

Open Brd – the form factor of this controller is an open circuit board mounted on four standoffs.

Manual Reset – the limit must be reset on a power cycle and requires manual reset on limit trip.

Multi RSP – multiple remote set potentiometers were supported. Each allowed the set point to be selected and adjusted.

Relay – refers to an electromechanical relay.

Remote – set point is adjusted using a remote potentiometer.

Panel – the form factor of this controller is mounted through a hole cut in the panel.

PI – Proportional and Integral, a control mode with two functions: proportional action dampens the systems response, and integral corrects for droop.

PID – Proportional, Integral, and Derivative, a control mode with three functions: proportional action dampens the systems response, integral corrects for droop, and derivative prevents overshoot and undershoot.

Potted – the circuit board and electronics are encased in epoxy.

Proc – Process input may accept 0-5, 1-5, 0-10 volts or 0-20 and 4-20 mA.

Profiling – Controller will perform a sequence of programmed steps.

Programmable – The feature is changeable in the field through jumpers and/or parameter selection.

RTD – Resistance Temperature Detector, a sensor that is 100 ohms at 0 degrees C and made of platinum material.

SSR – Solid State Relay, these devices will switch AC voltage only and require a load to latch on.

Sw DC – Switched DC, a time proportioning DC output used to drive DC input solid state relays.

t/c – Thermocouple sensor device made by joining two dissimilar metals whose standards is identified by a letter.

Temp Range – the range over which the controller could have the set point adjustment.

Thermistor – a sensor that changes resistance as the temperature changes. Similar but not the same as an RTD.

Universal – Input can be a thermocouple, 100 ohm DIN RTD or process (volts or milliamperes)

VAC – Volts Alternating Current

VAC/DC- Volts Alternating Current or Direct Current

VDC – Volts Direct Current

VTB Sw DC – Variable Time Base Switched Direct Current, a time proportioning DC output where the cycle time is variable.

These notes are used to signify areas of concern in changing to a retrofit choice. These notes are also printed at the end of the retrofit listing.

- Note 1: Retrofit controller requires a substitution of a 100 Ohm RTD sensor for the thermistor.
- Note 2: Mounting and dimensions of retrofit controller are different. Verify that sufficient panel space and depth is available.
- Note 3: Retrofit controller outputs are different. Add external interposing mechanical or solid state relay if applicable.
- Note 4: Retrofit controller has a programmable, not fixed set point. Lock set point using controller's lockout parameter.
- Note 5: For DIN rail mounting or sub-panel mounting, purchase DIN rail adapter p/n 0822-0586-P001 for 1/32 DIN or p/n 0822-0586-P002 for 1/16 DIN.
- Note 6: Add a suppressor, Watlow p/n 0804-0147-0000, for inductive loads.
- Note 7: Retrofit does not have equivalent action (as example, no manual reset)
- Note 8: Retrofit controller does not have dual dial scale.
- Note 9: Hardware lockout is not available on retrofit.
- Note 10: Retrofit controller does not have user selectable line voltage.
- Note 11: Retrofit does not support remote set point or retransmit. Check if pins 13, 14, 15 or 16 have termination. If wires are on these pins, select a different retrofit.
- Note 12: Retrofit controller does not have user selectable control action.
- Note 13: Solid state sensor required for humidity. See <http://www.vaisala.com>
- Note 14: Retrofit controller does not have user selectable control mode.
- Note 15: Use auxiliary event board A007-1732-F4B8
- Note 16: Retrofit communications are different, consult specifications.
- Note 17: Verify retrofit input range matches application.

Series 922

<u>Series 922</u>	<u>Line Voltage</u>	<u>Input</u>	<u>Control Mode</u>	<u>Action</u>	<u>Output</u>	<u>Set Point</u>	<u>Mounting</u>	<u>Retrofit</u>	<u>See Notes Below</u>
922A-1BB0-A000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6
922A-1BB0-B000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-1BB0-C000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-1CC0-A000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	
922A-1CC0-B000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-1CC0-C000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-1FB0-A000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6
922A-1FB0-B000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-1FB0-C000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-2BB0-A000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6
922A-2BB0-B000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-2BB0-C000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-2CC0-A000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	
922A-2CC0-B000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-2CC0-C000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-2FB0-A000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6
922A-2FB0-B000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-2FB0-C000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-3BB0-A000	115/230 VAC	T t/c/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6
922A-3BB0-B000	115/230 VAC	T t/c/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-3BB0-C000	115/230 VAC	T t/c/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-3CC0-A000	115/230 VAC	T t/c/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	
922A-3CC0-B000	115/230 VAC	T t/c/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-3CC0-C000	115/230 VAC	T t/c/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-3FB0-A000	115/230 VAC	T t/c/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6
922A-3FB0-B000	115/230 VAC	T t/c/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-3FB0-C000	115/230 VAC	T t/c/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-4BB0-A000	115/230 VAC	Proc/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6
922A-4BB0-B000	115/230 VAC	Proc/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-4BB0-C000	115/230 VAC	Proc/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-4CC0-A000	115/230 VAC	Proc/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	
922A-4CC0-B000	115/230 VAC	Proc/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-4CC0-C000	115/230 VAC	Proc/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-4FB0-A000	115/230 VAC	Proc/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6
922A-4FB0-B000	115/230 VAC	Proc/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-4FB0-C000	115/230 VAC	Proc/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-5BB0-A000	115/230 VAC	T t/c/T t/c	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6
922A-5BB0-B000	115/230 VAC	T t/c/T t/c	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-5BB0-C000	115/230 VAC	T t/c/T t/c	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-5CC0-A000	115/230 VAC	T t/c/T t/c	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	
922A-5CC0-B000	115/230 VAC	T t/c/T t/c	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16

Series 922

<u>Series 922</u>	<u>Line Voltage</u>	<u>Input</u>	<u>Control Mode</u>	<u>Action</u>	<u>Output</u>	<u>Set Point</u>	<u>Mounting</u>	<u>Retrofit</u>	<u>See Notes Below</u>
922A-5CC0-C000	115/230 VAC	T t/c/T t/c	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-5FB0-A000	115/230 VAC	T t/c/T t/c	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6
922A-5FB0-B000	115/230 VAC	T t/c/T t/c	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-5FB0-C000	115/230 VAC	T t/c/T t/c	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-6BB0-A000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6
922A-6BB0-B000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-6BB0-C000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-6CC0-A000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	
922A-6CC0-B000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-6CC0-C000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-6FB0-A000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6
922A-6FB0-B000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-6FB0-C000	115/230 VAC	RTD/RTD	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-7BB0-A000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6
922A-7BB0-B000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-7BB0-C000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-7CC0-A000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	
922A-7CC0-B000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-7CC0-C000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-7FB0-A000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6
922A-7FB0-B000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-7FB0-C000	115/230 VAC	RTD/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-8BB0-A000	115/230 VAC	K t/c/K t/c	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6
922A-8BB0-B000	115/230 VAC	K t/c/K t/c	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-8BB0-C000	115/230 VAC	K t/c/K t/c	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-8CC0-A000	115/230 VAC	K t/c/K t/c	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	
922A-8CC0-B000	115/230 VAC	K t/c/K t/c	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-8CC0-C000	115/230 VAC	K t/c/K t/c	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-8FB0-A000	115/230 VAC	K t/c/K t/c	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6
922A-8FB0-B000	115/230 VAC	K t/c/K t/c	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-8FB0-C000	115/230 VAC	K t/c/K t/c	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-9BB0-A000	115/230 VAC	J t/c/J t/c	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6
922A-9BB0-B000	115/230 VAC	J t/c/J t/c	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-9BB0-C000	115/230 VAC	J t/c/J t/c	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-9CC0-A000	115/230 VAC	J t/c/J t/c	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	
922A-9CC0-B000	115/230 VAC	J t/c/J t/c	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-9CC0-C000	115/230 VAC	J t/c/J t/c	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-9FB0-A000	115/230 VAC	J t/c/J t/c	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6
922A-9FB0-B000	115/230 VAC	J t/c/J t/c	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-9FB0-C000	115/230 VAC	J t/c/J t/c	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-ABB0-A000	115/230 VAC	J t/c/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6

Series 922

Series 922	Line Voltage	Input	Control Mode	Action	Output	Set Point	Mounting	Retrofit	See Notes Below
922A-ABB0-B000	115/230 VAC	J t/c/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-ABB0-C000	115/230 VAC	J t/c/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-ACC0-A000	115/230 VAC	J t/c/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	
922A-ACC0-B000	115/230 VAC	J t/c/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-ACC0-C000	115/230 VAC	J t/c/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-AFB0-A000	115/230 VAC	J t/c/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6
922A-AFB0-B000	115/230 VAC	J t/c/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-AFB0-C000	115/230 VAC	J t/c/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-BBB0-A000	115/230 VAC	K t/c/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6
922A-BBB0-B000	115/230 VAC	K t/c/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-BBB0-C000	115/230 VAC	K t/c/Proc	Programmable	Programmable	Dual 0.5A SSR/0.5A SSR	Profiling	1/4 DIN	F4DH-KKKK-01RG	6, 16
922A-BCC0-A000	115/230 VAC	K t/c/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	
922A-BCC0-B000	115/230 VAC	K t/c/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-BCC0-C000	115/230 VAC	K t/c/Proc	Programmable	Programmable	Dual Sw dc/Sw dc	Profiling	1/4 DIN	F4DH-CCCC-01RG	16
922A-BFB0-A000	115/230 VAC	K t/c/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6
922A-BFB0-B000	115/230 VAC	K t/c/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16
922A-BFB0-C000	115/230 VAC	K t/c/Proc	Programmable	Programmable	Dual 4-20MA/0.5A SSR	Profiling	1/4 DIN	F4DH-FKFK-01RG	6, 16

Event Board

A007-1732-18B2	115/230 VAC	Dual 0.5A SSR	Open Bd	A007-1732-F4B2
A007-1732-18B8	115/230 VAC	Eight 0.5A SSR	Open Bd	A007-1732-F4B8
A007-1732-18C2	115/230 VAC	Dual Sw dc	Open Bd	A007-1732-F4C2
A007-1732-18C8	115/230 VAC	Eight Sw dc	Open Bd	A007-1732-F4C8
A007-1732-18K2	115/230 VAC	Dual 0.5A SSR	Open Bd	A007-1732-F4K2
A007-1732-18K8	115/230 VAC	Eight 0.5A SSR	Open Bd	A007-1732-F4K8

Note 1: Retrofit controller requires a substitution of a 100 Ohm DIN RTD sensor.

Note 2: Mounting and dimensions of retrofit controller are different. Verify that sufficient panel space and depth is available.

Note 3: Retrofit controller outputs are different. Add external interposing mechanical or solid state relay if applicable.

Note 4: Retrofit controller has a programmable, not fixed set point. Lock set point using controller's lockout parameter.

Note 5: For DIN rail mounting or sub-panel mounting, purchase DIN rail adapter p/n 0822-0586-P001 for 1/32 DIN or p/n 0822-0586-P002 for 1/16 DIN.

Note 6: Add a quencharc suppressor, Watlow p/n 0804-0147-0000, for inductive loads.

Note 7: Retrofit does not have equivalent action (as example, no manual reset)

Note 8: Retrofit controller does not have dual dial scale.

Note 9: Hardware lockout is not available on retrofit.

Note 10: Retrofit controller does not have user selectable line voltage.

Note 11: Retrofit does not support remote set point or retransmit. If wires are on these pins, select a different retrofit.

Note 12: Retrofit controller does not have user selectable control action.

Note 13: Solid state sensor required for humidity. See <http://www.vaisala.com>

Note 14: Retrofit controller does not have user selectable control mode.

Note 15: Use auxiliary event board A007-1732-F4B8

Note 16: Retrofit communications are different, consult specifications.

Note 17: Verify retrofit input range matches application.



Series 922

User's Manual




Microprocessor-Based Ramping Control



Watlow Controls, 1241 Bundy Blvd., P.O. Box 5580, Winona, MN 55987-5580, Phone: 507/454-5300, Fax: 507/452-4507

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Use The Manual

First...	<i>This manual will make your job easier.</i> Reading it and applying the information is a good way to become familiar with the Series 922. Here's an overview:
Starting Out	Introduction, Chapter 1.
Front Panel	Keys and Displays, Chapter 2.
Running a Program	Sample Program, Chapter 3.
Install/Wire	Installation and Wiring, Chapter 4.
Tune	How to Tune, Chapter 5.
Programming	How to Program, Chapter 6.
Alarms	How to Use Alarms, Chapter 7.
Appendix	Specifications Glossary Calibration Warranty

Series 922 error codes and prompts, see Pages 87 - 89.


Notes, Cautions, and Warnings


We use note, caution, and warning symbols throughout this book to draw your attention to important operational and safety information.

A bold text "**NOTE**" marks a short message in the margin to alert you to an important detail.

A bold text "**CAUTION**" safety alert appears with information that is important for protecting your equipment and performance. **Be especially careful to read and follow all cautions that apply to your application.**

A bold text "**WARNING**" safety alert appears with information that is important for protecting you, others, and equipment from damage. **Pay very close attention to all warnings that apply to your application.**

The  symbol (exclamation point in a triangle) precedes a general CAUTION or WARNING statement.

The  symbol (a lightning bolt with an arrowhead in a triangle) precedes an electric shock hazard CAUTION or WARNING safety statement.

Comments and Suggestions

Your comments or suggestions on this manual are welcome, please send them to: Technical Writer, Watlow Controls, 1241 Bundy Blvd., P.O. Box 5580, Winona, MN 55987-5580, or phone 507/454-5300. The Watlow Series 922 User's Manual and integral software are copyrighted by Watlow Winona, Inc., © 1988 with all rights reserved.

Table of Contents

Page	Item	
7	Starting out with the Watlow Series 922 - Chapter 1	Starting Out
7	"Read Me First"	
8	Packing List	
8	Put Your Control to Work —Three Steps	
9	How to Open the 922	
9	How to Set the DIP Switches	
10	Changing the Position of a DIP Switch	
11	Overview of the Three Operating Modes	
12	How to Use the Keys and Displays - Chapter 2	Front Panel
12	Front Panel Information	
13	Actual and Alphanumeric Display Area	
13	Keyboard Area	
14	Learning the Series 922 - Chapter 3	Sample Program
14	A Brief Overview	
15	Enter Real Time	
15	Before Entering Your Program	
16	Programming File 1	
17	Running Your Program	
17	Editing Your Program	
18	Adding an AUTOSTART Step Type	
18	LINKing Files	
19	The WAITFOR Step	
20	Running Your Series 922	
21	How to Install and Wire the Series 922 - Chapter 4	Install and Wire
21	Sensor Installation Guidelines	
22	Input Power Wiring	
23	Definitions	
23	The Dos and Don'ts of Clean Input Power	
24	How to Check for Ground Loops	
24	How to Eliminate Noise	
24	Noise Suppression Devices Available from Watlow	
24	Line Filtering Configurations For Controls	
26	Installation Information	
26	Installation Procedure	
28	Series 922 Power Wiring	
29	How to Wire the Series 922	
29	Input Wiring	
32	Output Wiring	
33	Event Output Board	
35	System Wiring Example	

Contents

	Page	Item
Tuning	36	How to Tune the Series 922 - Chapter 5
	36	Recommended Tuning Reference
	36	Using a Chart Recorder
	37	Tuning
Programming	38	How to Program the Series 922 - Chapter 6
	38	Write Out Your Program
	38	Select the Proper DIP Switch Settings
	38	Event Input
	38	Remote Hold Input
	39	Event Outputs
	39	Guaranteed Soak
	40	The Four JUMPLOOP Types
	41	JUMPLOOP Rules to Follow
	42	Programming in General
	42	SYSTEM Menu
	45	SETUP Menu
	57	PROGRAM Menu
Alarms	63	How to Use the Series 922 Alarms - Chapter 7
	63	Alarm Relay Configuration
	63	Number of Alarms
	64	Alarm Types
	65	The Operating Band
	65	Alarm Limits
	66	Alarm Function, Latching or Non-Latching
	67	Clearing an Alarm Message
	67	An Alarm And The State Of The Alarm Relay
Appendix	68	Appendix
	68	Specifications
	70	Model Number Information
	71	Thermocouple Field Calibration Procedure
	73	RTD Field Calibration Procedure
	75	Process Field Calibration Procedure
Terminology	76	Glossary
	83	Index
	85	Warranty
	85	Returning Merchandise
	86	Shipping Claims
	86	Watlow Controls
Quick Reference	87	Series 922 Error Codes/Alarms
	88	Series 922 Quick Reference

Figures

Page	Item	Figures
7	Series 922 Input and Output Overview	Figure 1
9	How to Open the Series 922	Figure 2
10	DIP Switch Location and Orientation	Figure 3
11	Overview of the Series 922	Figure 4
12	Series 922 Front Panel Information	Figure 5
13	Actual and Alphanumeric Display Front Panel Information	Figure 6
13	Keyboard Front Panel Information	Figure 7
20	RUN Key Flow Diagram	Figure 8
25	Differential Mode Filter Diagram	Figure 9
25	Common Mode Filter	Figure 10
25	Combination Differential- Common Mode Filter Diagram	Figure 11
26	Series 922 Faceplate Dimensions	Figure 12
27	Series 922 Dimensions (Side View)	Figure 13
27	External Event/Alarm Board Dimensions (Side & End view)	Figure 14
27	Series 922 Panel Cutout Dimensions	Figure 15
28	Series 922 Power Wiring Diagram	Figure 16
29	Input Option "1" & "6", Dual RTD, Wiring Diagram	Figure 17
30	Input Option "2" & "7", RTD/Process, Wiring Diagram	Figure 18
30	Input Option "3", T/C and Process, Wiring Diagram	Figure 19
31	Input Option "4" Dual Process, Wiring Diagram	Figure 20
31	Input Option "5", Dual T/C, Wiring Diagram	Figure 21
32	Dual S.S. Relay Output, Option "BB", Wiring Diagram	Figure 22
32	Solid State Switch, Option "CC", Wiring Diagram	Figure 23
32	4-20mA/Solid State Output, Option "FB", Wiring Diagram	Figure 24
33	External Event/Alarm Board Information	Figure 25
33	External Board Control Power	Figure 26
33	Ribbon Cable Connector to Series 922	Figure 27
34	Event Output Option "B" and "K" SSR Wiring Diagram	Figure 28a
34	Event Output Option "C" Switched DC Wiring Diagram	Figure 28b
35	Series 922 System Wiring Example	Figure 29
39	Guaranteed Soak (GS) Example	Figure 30
42	SYSTEM Key Flow	Figure 31
45	SETUP Key Flow	Figure 32
57	PROGRAM Key Flow	Figure 33
64	Alarm Type for Alarm 1 is "Process" Alarm (ALYP1 = P)	Figure 34
64	Alarm Type for Alarm 1 is a "Deviation" Alarm (ALYP1=D)	Figure 35
65	Alarm Limits for alarms 1 and 2 with "Process" Type Alarm (ALYP1 = P, ALYP2 = P)	Figure 36
66	Alarm Limits for Alarms 1 and 2 with "Deviation" Type Alarm (ALYP = D, ALYP = D)	Figure 37
71	Reference Compensator-to-Series 922 Connector Diagram	Figure 38
73	Decade Resistance Box-to-Series 922 Connection Diagram	Figure 39
75	Voltage/Current Source to Series 922 Connection Diagram	Figure 40

Contents

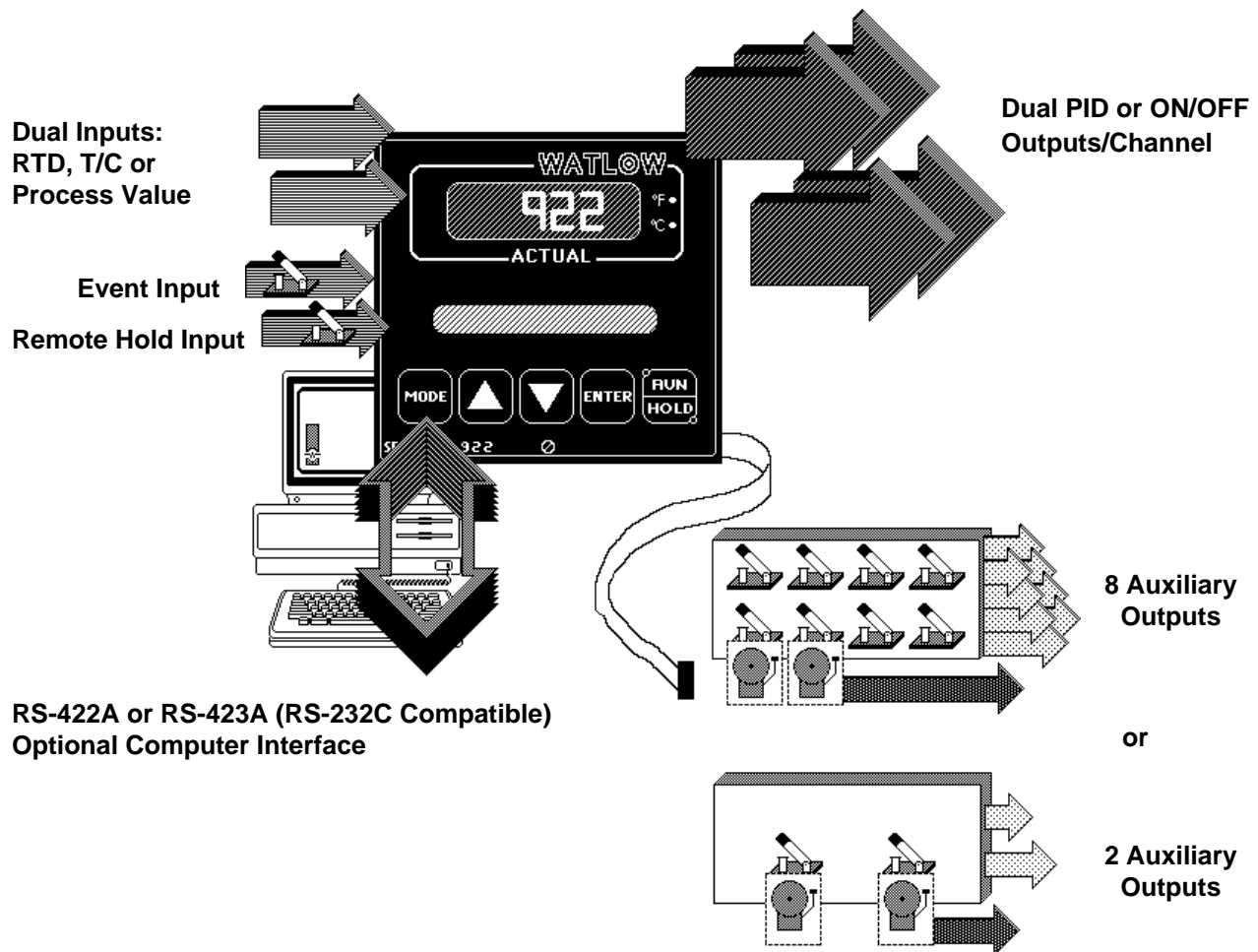
Tables

Page	Item	Table
10	DIP Switch Selection	Table 1
16	Series 922 Ramp and Soak Program	Table 2
17	Editing Your Program, Steps 4-7	Table 3
18	Adding the AUTOSTART Step	Table 4
18	LINKing to Another File	Table 5
19	The WAITFOR Step	Table 6
24	Noise Suppression Device Ratings	Table 7
43	SYSTEM Prompts and Description	Table 8
46	SETUP Prompts and Description	Table 9
58	PROGRAM Prompts and Description	Table 10
74	RTD Parameter Settings	Table 11

Chart

Page	Item	Chart
62	Master Step Chart	Chart 1

Starting out with the Watlow Series 922, A 2-Channel Ramping Control



"Read Me First."

Congratulations, you're about to become a fully-qualified user of the Watlow Series 922! This versatile microprocessor-based ramping control is powerful, yet simple to learn. A ramp progresses from one set point to another set point over a period of time. In this chapter of the user's manual, you'll get an overview of the 922 and its operation.

Figure 1 is a simplified view of the Series 922's capabilities. It is a 2-channel, dual output per channel, microprocessor-based, 1/4 DIN-sized ramping temperature control. The 922 accepts dual inputs, one per channel. This includes Type J, K or T thermocouple, a 1° or 0.1° RTD input, or one of two process inputs. You can order an external event output board with two or eight auxiliary outputs. It has a full control temperature range, offset calibration, and a front panel lockout feature.

**Figure 1 -
Series 922 Input and
Output Overview**

Starting Out

The Series 922 is a dual channel PID controller. You may input individual sets of PID parameters for each output. This includes rate, reset, proportional band and cycle time. By setting the proportional band(s) to zero, the Series 922 becomes a simple ON/OFF control, with a 3°F or 1.7°C switching differential.

Two of the Series 922's auxiliary outputs may be alarms or events. An event is an ON/OFF auxiliary output relay signal. You can use events, based on time, to trigger peripheral equipment or processes. Depending on your individual system needs, you may order an external event board with two or eight outputs.

Operator-friendly features include automatic entry codes or "prompts" to aid in setup. When there's a power outage, the Watlow Series 922 stores all information in a nonvolatile memory.

When you first apply power, the unit will "come up" with default values for set points and control parameters. These default values provide minimum operating information for the control until you program in the desired data. The default values are listed in the Master Step Menus and Charts, pp. 46-61.

Remove the Series 922 carefully from its shipping container. Be sure to set this literature aside where it will not be discarded.

Packing List

Included with your Watlow Series 922 are two mounting brackets with integral screws, and this manual.

Put Your Control to Work—Three Steps

Once your control is installed and wired, getting the Series 922 "up and running" is a three-part process:

- First, match the control's "personality," to your system in what we call the SETUP menu; that is input type, units of measure, range, calibration offset, output action, alarm type, lockout.
- Second, tune the control, making final PID entries.
- Third, enter up to ten separate profiles in the PROGRAM menu.

How to Open the 922

Before going further, open the Series 922 and pull the control chassis from its case. Here's how:

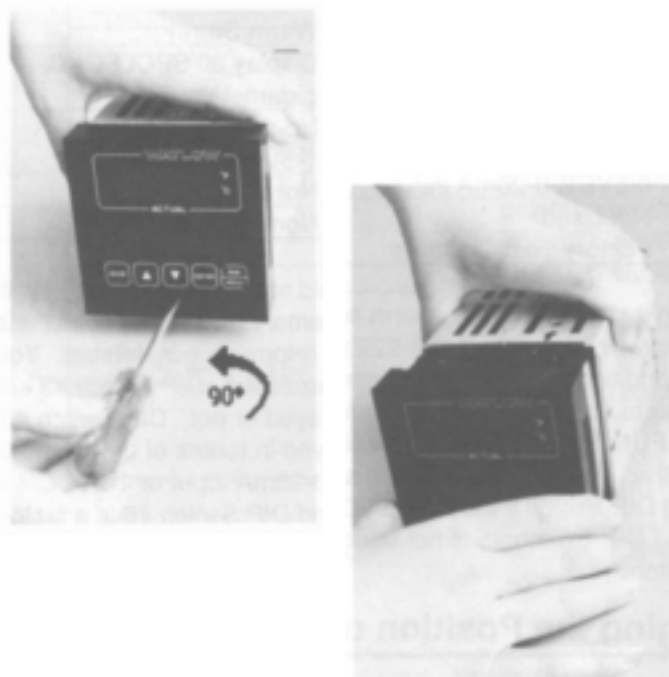
The control chassis fastens to the case with a single screw located on the lower front panel. See Figure 2. Turn the screw counterclockwise to loosen it. Three or four strip connector plugs, in the rear of the control chassis, feed power and signals through the back of the casing to the triple terminal strip. These plugs will let go as you pull.



When removing the Series 922 Control from its case, pull firmly but gently. When returning the control to the case, be sure you **have the top up** to match the plugs with the case. The 922 will not fit in to the case upside down. Always check to see that it is oriented correctly. Press the unit in firmly, then turn the front panel screw clockwise to secure it.



CAUTION:
The front panel screw turns 90° only. Do not apply excessive force or turn the screw more than 90°.



**Figure 2 -
How to Open the
Series 922.**

How to Set the DIP Switches

The Watlow Series 922 has a set of Dual In-line Package (DIP) switches inside the control on circuit board A007-1727. The locations of the board and switches appear in Figure 3. The switches are clearly numbered from left to right. You will use DIP Switches #1-4 and #6; #5 is not used. Table 1 on the next page shows the DIP switch selections.

DIP Switches

Figure 3 -
DIP Switch Location
and Orientation.

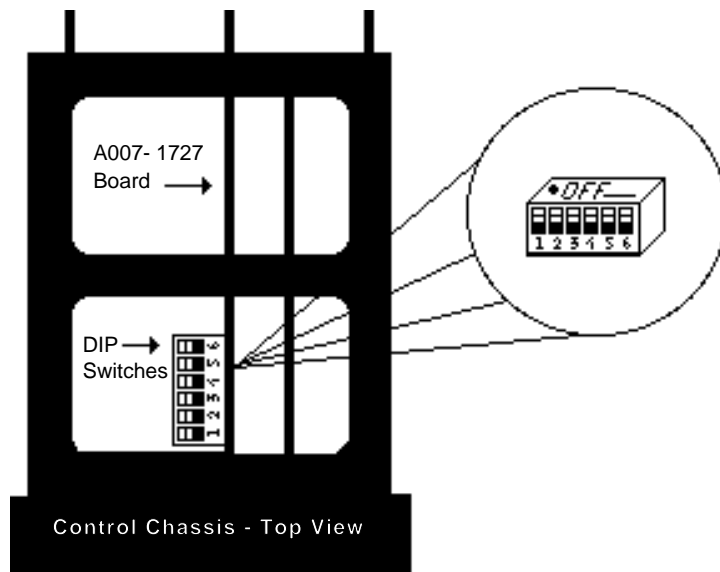


Table 1 -
DIP Switch Selec-
tion.

DIP SW#	Function		Normal Operating Position
	ON	OFF	
1	Cold Start	Warm Start	OFF
2	Display the factory selected SPCLFUNC parameters	Display all SPCLFUNC parameters	Choose
3	Tenths of units displayed	No decimal displayed	Choose
4	0-5VDC/0-20mA input	1-5VDC/4-20mA input	Choose
5	Not Used	Not Used	OFF
6	Factory Test/Calibrate	Normal Operation	OFF

WARNING:
Doing a cold start
will cause all SETUP
parameters and files
to be lost. DO NOT
put DIP switch #1 in
the ON position
unless all user-
programmed
information is to be
cleared.

SPCLFUNC param-
eters define the
personality of your
Series 922. Such as
input type, units of
measure, range,
calibration offset,
output action, alarm
type, and lock out.

DIP Switch #1 determines a warm or cold start. A "warm" start will save all programmed information in the 922's memory backup. A "cold" start is a "clean" startup condition; all user-programmed information is deleted. Your Series 922 leaves the factory programmed for a warm start. DIP Switch #2 selects whether all **SPCLFUNC** parameters will be displayed or not. DIP Switch #3 determines whether the decimal point will be displayed in tenths of units for 0-5V or 4-20mA input and DIP Switch #4 is for 0-5VDC/0-20mA input or 1-5VDC/4-20mA input selection. DIP Switch #5 is not used, and DIP Switch #6 is a factory test/calibrate switch.

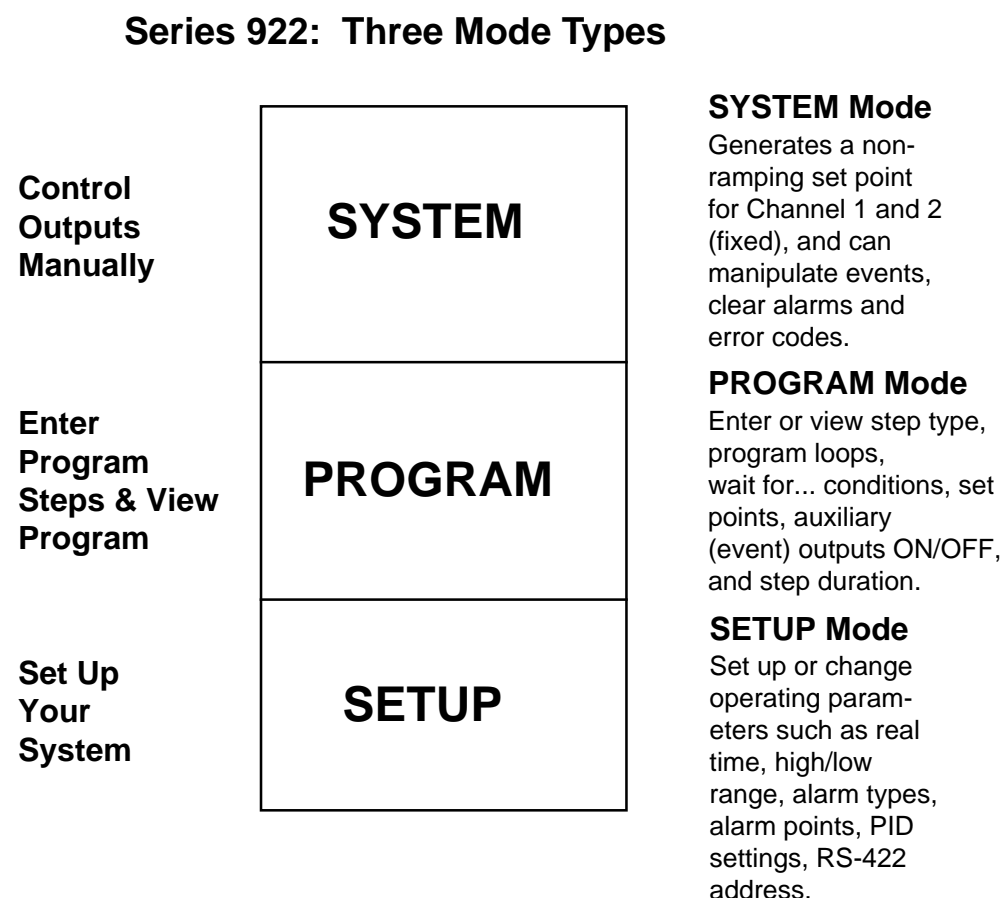
Changing the Position of a Switch

Whenever you change the position of a DIP switch, follow this procedure:

1. Remove power from the Series 922. Turn the front panel screw 90° counter-clockwise.
2. Grip the front panel bezel and pull it straight out from the control case. The control chassis will come out of the case as you pull the bezel.
3. Set the DIP switch to the position you want.
4. Return the control chassis to the case. Be sure you have it oriented correctly. It will not fit in upside down, but check just the same. Press firmly, but gently, to seat the chassis.

Overview of the Three Operating Modes

Before getting into the details of the Series 922's keys and displays, take a look at Figure 5 showing the three different modes. After you feel comfortable with the names of the modes and their functions, go ahead to learn the keys and displays.



**Figure 4 -
Overview of the
Series 922
Operating
Modes**

Where To Go From Here...

You are now ready to continue to How to Use the Keys and Displays, Chapter 2.

Chapter 2

How to Use the Keys and Displays

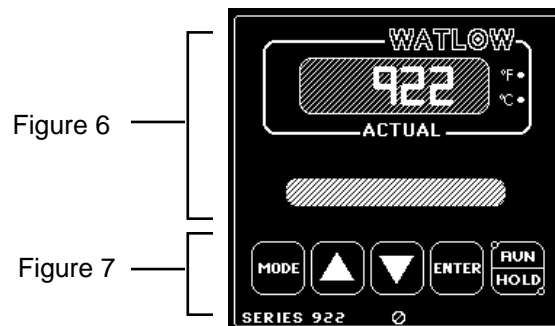
This chapter will show you the Series 922 front panel, and the function of each display, key and LED. Figures 6 and 7 explain the 922 front panel.

Front Panel Information

Use Figures 6 and 7 to assist you in learning the locations and functions of the front panel components.

Use the following figures to learn the nature and function of the Series 922's keys and displays.

**Figure 5 -
Series 922 Front
Panel Information**



Where To Go From Here

Once you have studied the keys and displays in this chapter, and have a good idea of where everything is on the Series 922, continue to Chapter 3 for the Sample Program. If you skip the sample program, do not forget to check the position of DIP Switch #1 before you begin programming your control after installation. With DIP Switch #1 OFF, the 922 saves your program whenever power is removed (warm start). With DIP Switch #1 ON, the 922 will clear its memory of all programmed information whenever power is removed, substituting default values (cold start).

Actual and Alphanumeric Display Area

Keys / Displays

ACTUAL Display
Shows the actual value of the process variable for Channel 1 in four digits.



Alphanumeric Display
Shows entry prompts, the parameter values in alphanumerics and Channel 2 ACTUAL value.

°F LED

Indicates the value in the ACTUAL display is temperature in degrees Fahrenheit.

When both °C and °F LEDs are OFF, the 922 is displaying Process Variable Units (PVUs).

°C LED

Indicates the value in the ACTUAL display is temperature in degrees Celsius.

Figure 6 - Actual and Alphanumeric Display Front Panel Information

Keyboard Area

DOWN Key

Acts opposite the UP key. Decreases the value in the alphanumeric display. A light touch decreases the value by one digit. Hold the key down to decrease the displayed value at a rapid rate.

MODE Key

This key steps the Series 922 in sequence from prompt to prompt.

RUN/HOLD Key

Executes or holds a program from any Main menu.

UP Key

Increases the value in the alphanumeric display. A light touch increases the value by one digit. Hold the key down to increase the displayed value at a rapid rate.



90° Front Panel Screw

Secures the control chassis in its case with a 1/4 turn clockwise or releases the chassis with a 1/4 turn counter-clockwise.

ENTER Key

Enters selected (flashing) data into the micro-processor memory. This will clear an error code, or latched alarm indications when the ACTUAL display value returns to within the alarm limit.

Run/Hold LEDs

When the HOLD LED is ON steady, the 922 is in a HOLD condition. When the HOLD LED flashes, the unit is in a WAITFOR step or has exceeded the guaranteed soak deviation..

When the RUN LED is ON the 922 is in the RUN condition.

When the RUN LED is flashing, the program is being held by the remote hold input.

Figure 7 - Keyboard Front Panel Information

Chapter 3

Learning the Series 922 - A Sample Program in Action

This chapter will guide you through an easy sample program for the Series 922. You can quickly grasp the necessary terms and concepts by entering values and then observing this exercise.

If you feel that your knowledge of ramping controllers does not require a sample program to learn the Series 922, skip this chapter.

A Brief Overview

This sample program teaches you the fundamentals of creating a ramping profile, along with ways to expand that profile to its greatest versatility.

The program example starts with a simple ramp and soak profile. A "ramp" progresses from one set point to another set point over a period of time. Soaking controls the length of time the temperature holds at this level.

We then expand it to multiple ramp and soaks, add JUMPLOOP functions, perform an AUTOSTART, LINK to another profile, and finally perform a WAITFOR step.

This sample program only goes through the steps of programming Channel 1 of the Series 922. The process for Channel 2 is the same. Events 3 through 8 are not shown.

At this point make copies of your Master Step Chart on Page 62. It is a good practice to keep track of your program as you go. It's also a good idea to sit down and define exactly what you want your program to do.

Clear Memory, Set DIP Switches

If you haven't already cleared your Series 922's memory, do a "Cold Start." Turn the power OFF, open the 922 and ensure that DIP Switch #1 is ON. Apply power momentarily and reset DIP Switch #1 to OFF. The program memory is now cleared. If you haven't done so already, attach your sensor as described in Chapter 4.

WARNING:
Doing a cold start will cause all SETUP parameters and files to be lost. DO NOT put DIP switch #1 in the one position unless all user programmed information is to be cleared.

Enter Real Time

First, set the Series 922's "real time-of-day, 24-hour clock. Remember that the MODE key is used to step through the menus. The UP/DOWN keys are used to select parameters and values, and remain flashing until you press the ENTER key.

1. Press the MODE key until the SETUP menu appears. Press the ENTER key.
2. At ACCESS, select (0) with the UP/DOWN keys. Press ENTER. This is the calibration (CALIB) menu.
3. Press the MODE key until HOUR appears in the alphanumeric display. Note that hours are in a 24 hour format.
4. Use the UP/DOWN keys to place hours into the display. The display flashes until you press ENTER.
5. Press MODE to continue to the MIN parameter. Enter the correct value for minutes and press ENTER.
6. Press the MODE key several times to return to the top of the ACCESS (0) menu. At the ACCESS (0) prompt, which is the CALIB menu, you see the Real Time (TI) displayed.
7. Continue to press MODE until you reach RETURN. Press ENTER to return to SYSTEM.

NOTE: When either the hours or minutes are entered, internal seconds are set to 0.

Before Entering Your Program

Before we begin to program your Series 922, there are a few other initial SETUP parameters to enter. If you haven't tried any programming since your cold start, the C/F/U (Celcius/Fahrenheit/Units) and GS (Guaranteed Soak) parameters are set to their appropriate values. Refer to the glossary for a more detailed definition. If you have already tried stepping through the parameters and entering values, it might be a good idea to go back and double check to see that the values are correct.

1. Press the MODE key until SETUP appears. Press ENTER. Once again you see the ACCESS parameter. Use the UP/DOWN keys to enter (5) and press ENTER; this is the Special Function (SPCLFUNC) menu.
2. Press MODE again until you see the C/F/U parameter. This parameter defaults to F. Use the UP/DOWN keys to enter degrees F (Fahrenheit). Press ENTER.

NOTE: DIP Switch #2 must be OFF to access all SPCLFUNC parameters.

Sample Program

Skip Step 3 if you do not have an external event board connected.

- Continue through the menu with the MODE key until you see AUX1. Use the UP/DOWN keys to enter AUX1 as an event (EV) and press ENTER. Do the same for AUX2. Default is AL (Alarm).
- Continue through the SPCLFUNC menu until you see GS (Guaranteed Soak). Enter a value of (0); press ENTER. This parameter defaults to 0.
- Press the MODE key to move to the RETURN parameter. Press ENTER to return to SYSTEM.

Programming File 1

Our first step in programming is to make a short ramp and soak program. Step 1 initializes the set point to a known starting point for the ramp, Step 2 is a short ramp, Step 3 is a soak step, which holds the programmed set point constant for the programmed time. Step 4 is a STOP step which signals the end of a file.

- From the SYSTEM menu, press MODE until you see the PROGRAM menu. Press ENTER.
- The Series 922 asks you for a FILE?. Your 922 should already say (1), but if you have entered any values, it may be different. Make sure it says (1). Press ENTER.
- The display now shows STEP with a 1 flashing. Use the UP/DOWN keys to select (1) then press ENTER if it is not already there.
- Press the MODE key. Use the UP/DOWN keys to select the step type and values. Press ENTER. Use Table 2 to enter the corresponding parameters and values. The parameters appear from left to right on the table.

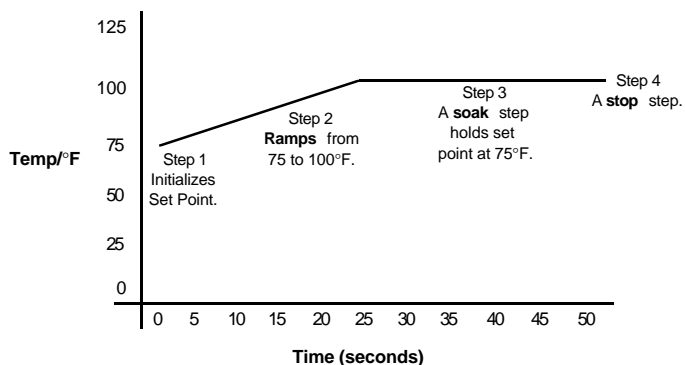
NOTE: EV1 and EV2 will not appear unless the Event Output board is connected, and AUX1 and 2 are events.

At the end of each menu, rather than press ENTER at the RETURN parameter to get to SYSTEM, press MODE for the STEP prompt. The step number automatically increments and flashes. Press ENTER.

**Table 2 -
Series 922
Ramp and Soak
Program**

FILE?	STEP	STEP TYPE	SP1	HOUR	MIN	SEC	EV1	EV2
1	1	SETPOINT	75	0	0	1	OFF	OFF
1	2	SETPOINT	100	0	0	25	ON	OFF
1	3	SETPOINT	100	0	0	25	ON	OFF
1	4	STOP						

NOTE: Step 4 must be entered as a step even though it defaults to a STOP step.



1. Return to SYSTEM using the ENTER key at the RETURN prompt. Press the RUN/HOLD key.
2. The 922 asks what FILE? to run. Enter (1) if it is not already entered.
3. The 922 asks what step you would like to start on. Again, press (1) if it is not already there, and press ENTER.

The 922 quickly shows the step type and jumps to Step 1; the RUN LED is lit. After each step is completed, the next step the 922 performs appears.

You may step through the parameters to see what the step type is and what the parameters are set at by pressing the MODE key. The Time Remaining is also displayed at the end of the menu. Once the Time Remaining reaches 00:00:00, it shows what step the profile has progressed to.

Editing Your Program

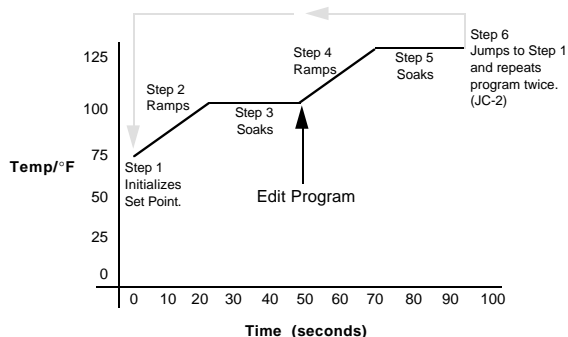
Now let's try editing the program by expanding it with another ramp and soak step, and adding a jump loop. We'll jump to Step 1 and repeat Steps 1 through 6 two more times. This is accomplished by programming a Jump Step (JS) = 1 and Jump Count (JC) = 2. This means that once the 922 goes through the program and reaches Step 6, it jumps back to Step 1 and repeats the program two more times.

By this time you should understand the basic concept of the Series 922 and be able to get around on your own. Remember that the MODE key takes you through the menus. Use the UP/DOWN keys to select parameters, values and step types. Press ENTER and your information is entered.

1. Return to the PROGRAM menu.
2. Enter FILE? (1), Step (4). We are going to change this step type from a STOP step to a SETPOINT step. This is our second ramp. Use Table 3 to enter values into the corresponding parameters.
3. Once you have edited your program, run it again and watch its progress.

FILE?	STEP	STEP TYPE	SP1	HOUR	MIN	SEC	EV1	EV2	JS	JC
1	4	SETPOINT	125	0	0	25	OFF	ON	-	-
1	5	SETPOINT	125	0	0	25	OFF	ON	-	-
1	6	JUMLOOP	-	-	-	-	-	-	1	2
1	7	STOP								

**Table 3 -
Editing Your
Program,
Steps 4 - 7**



Sample Program

Adding AUTOSTART and LINKing Files

The Series 922 gives you the capability to link files together. The LINK step allows you to link the last step of a profile to the first step of another profile.

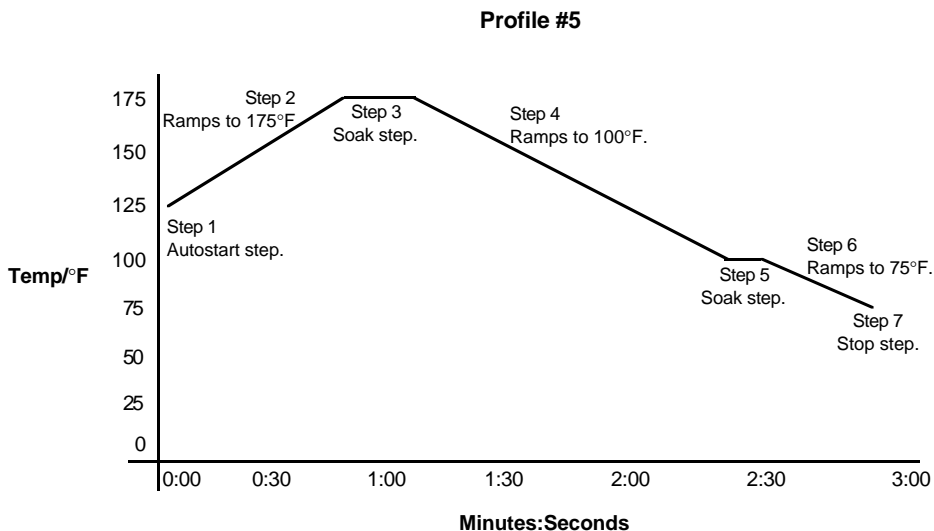
We are going to edit the program again by adding a LINK step at the end of the profile. First, we must create another file. If you try to run your program with a LINK that goes to a nonexisting file, you will receive ER2 0036. This error means "no file found." Follow Table 5 to add a LINK and a new FILE to your program.

The 922 can also automatically start your program, or a step, on a specified day and time. When you use an AUTOSTART in your program, it stops your program, and waits for the day and time you entered under the AUTOSTART step type. The Series 922 then executes the next sequential step. AUTOSTART allows you to wait up to seven days in the future; day 0 is always the current day. The days accumulated increases by 1 every time the Real Time clock goes from 23:59 to 00:00. If 0 is programmed for DAY, and the Real Time clock is greater than the programmed AUTOSTART time, the AUTOSTART waits 6 days along with the programmed time.

**Table 5 -
LINKing to
Another File with
AUTOSTART.**

FILE?	STEP	STEP TYPE	SP1	DAY	HOUR	MIN	SEC	EV1	EV2	FILE?
1	8	LINK								5
5	1	AUTOSTART		0	current	current + 5				
5	2	SETPOINT	175		0	0	50	ON	ON	
5	3	SETPOINT	175		0	0	20	ON	ON	
5	4	SETPOINT	100		0	1	15	ON	OFF	
5	5	SETPOINT	100		0	0	10	ON	OFF	
5	6	SETPOINT	75		0	0	25	OFF	OFF	
5	7	STOP								

Run your program again beginning at FILE 1, STEP 8. Step through the menu to see what step type you are on, and your time remaining. Watch to see what happens at the end of File 1. The AUTOSTART waits for approximately 5 minutes into the future before continuing with File 5.



The WAITFOR Step

The last step type we will work with is the WAITFOR step. This is a test step. It compares a specified temperature with the process temperature, or a specified event state with the event input, before continuing the program. It can also wait for a programmed time to elapse before continuing on with the program. After the test is successful, the program continues with the next sequential step. Events **cannot** be programmed in this step; they maintain their previous state.

Return to PROGRAM and enter FILE? (5). Add a WAITFOR step to the end of that file.

FILE	STEP	STEP TYPE	W1	WHR	WMN	WE
5	6	WAITFOR	-	-	-	-
5	7	STOP				

**Table 6 -
The WAITFOR Step**

WHR, WMN, WE and W1 are unprogrammed. To program a WAITFOR time, enter your values for WHR and WMN. The programmed WAITFOR time waits until the specified amount of time has elapsed. WAITFOR time (WHR, WMN), WE, and Channel 1 process variable (W1) can be programmed simultaneously. Each of these Wait For conditions must be met before the program will continue. Once a WAITFOR condition is satisfied it latches, and does not have to be performed again.

Run your program from FILE 5, STEP 1. If you do not want to go through the entire program, you can START your program at any STEP in FILE 1 or 5. When your program reaches FILE 5, STEP 6, the HOLD LED begins flashing. This means your program is still running, but it is HOLDing, to WAITFOR the ACTUAL temperature to equal the WAITFOR Channel 1 (W1). When they are equal, the HOLD LED stops flashing. Your program continues to the last step, a STOP step, and HOLDS again. In the HOLD mode the Series 922 controls the process to the set points of the last SP step.

If you want to change a programmed step, return to the PROGRAM menu, and enter the FILE and STEP number you want changed. Use the UP/DOWN keys to select another step type and press ENTER.

To clear all parameters under a step type of its programmed values, return to that step type and press ENTER. All parameters return to their defaults.

Sample Program

Running Your Series 922

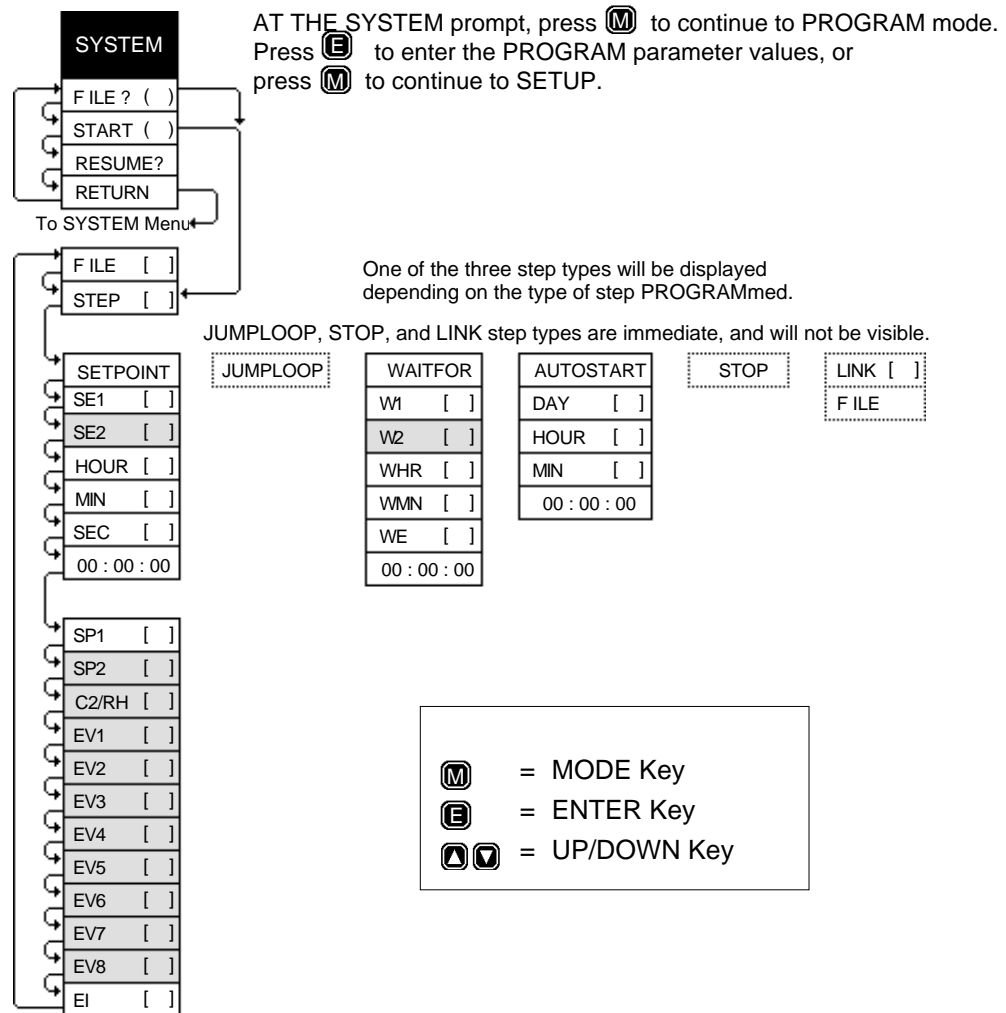
To run your Series 922, you must be at one of the three main level operating parameter menus, SYSTEM, PROGRAM, or SETUP. Press the RUN/HOLD key. The Series 922 asks what file you want to run, and asks what step to begin with. After entering the file and step number, your program begins, and the RUN LED is lit. While in the RUN mode, you can only view the current file and step.

To stop a running program, press the RUN/HOLD key. To resume a previously halted program press the RUN/HOLD key. When the FILE? parameter appears, press the MODE key to advance to the next parameter. When START appears, press the MODE key again. Next, the RESUME? parameter is now present. Press ENTER.

RUN Menu

NOTE: Shaded parameters may not appear on your control. These parameters are dependent on how your control is configured. See Chapter 6 for more information.

Figure 8 - RUN Key Flow Diagram



Where To Go From Here

Good job! You've just programmed and run the Series 922 sample program. As soon as you feel comfortable with the Series 922 sample program, move on to Installation and Wiring, Chapter 4. Or if you have already installed and wired your system, go to the Master Step Chart in Chapter 5 and begin entering and documenting your Series 922 program.

Chapter 4

How to Install and Wire the Series 922

This chapter tells you how to install the Series 922. All mounting and wiring information is right here. Because Watlow controls are thoroughly tested, and "burned in" before leaving the factory, the Series 922 is ready to install when you receive it.

But before you begin working or cutting holes in panels, read through this chapter to gain an understanding of the entire installation. Consider sensor installation carefully. You'll need to look at the noise reduction guidelines before making your panel cutout.

Miscellaneous Sensor Information

Temp - RH

Wet Bulb/Dry Bulb - In this 922 configuration, a dry bulb RTD measures temperature on Channel 1. A wet bulb RTD, in combination with the dry bulb RTD, senses relative humidity on Channel 2. The 922 calculates the temperature difference between the two bulbs to determine per cent relative humidity.

The humidity/dehumidify outputs (Outputs 3 & 4) are disabled when the Channel 1 temperature falls below 32°F/0°C, or goes above 212°F/160°C. The RH display reads OFF, and the retransmit output is 0 (volts) if ANLG = C2. ANLG is located in the Setup menu under Access (5).

Solid State - RH Sensor

Vaisala Model HMM 30C Relative Humidity Sensor - With the Vaisala configuration, Channel 1 must be configured to measure temperature, and Channel 2 must be a process input configured for humidity with the Vaisala sensor. See below for the TYP parameter description. This parameter is located in the Setup menu, under Access (5). DIP switch #4 must be set to the ON position. The humidity and dehumidify outputs (Outputs 3 & 4) are disabled when the Channel 1 temperature falls below -40°F/-40°C or goes above 320°F/160°C. The RH display will read OFF and the retransmit output is 0 (volts) if ANLG = C2. ANLG is located in the Setup menu under Access (5).

NOTE: The dry bulb and wet bulb sensor should be mounted in the same location. However, do not locate the wet bulb ahead of the dry bulb in the air stream, this could cause incorrect relative humidity readings.

Temp - Temp

For Temp-Temp RTD operation, each dry bulb RTD or thermocouple senses temperature for its channel.

RTDs

The RTDs for the Series 922 are customer-supplied items. They may be Gordon Part #S001-0133-0000, which is a wire-wound RTD inside a sealed, 18% Nickel-Silver sheath, made for fast temperature response. The detector element is platinum wire 100Ω at 0°C with a temperature coefficient of 0.003916Ω/Ω/°C. The sheath is 0.1875 in. (4.7625mm) diameter, 2.75 in. (69.85mm) long. The three wire leads are 48 in. (1219.2mm) long and teflon insulated.

Contact Gordon at:
5710 Kenosha St., Box 500
Richmond, IL 60071
Phone: 815/678-2211

Excessive lead length in a two-wire RTD sensor can create indication errors. To combat this, use a three wire sensor in long lead applications.

RTD - The Dry Bulb Installation

We suggest you mount the dry bulb RTD at a location in your process or system where it reads an average temperature. Air flow past this sensor should be moderate. The sensor should be thermally insulated from the sensor mounting.

RTD - The Wet Bulb Installation

One way to prepare the RTD wet bulb sensor for reading relative humidity on Channel 2 is to slip a cotton wick over the sensor sheath, Watlow Part # 0830-0111-0000 or an equivalent. Put one end of the wick in water. Some systems use a small trough of water with a float valve to replenish the evaporating liquid.

Use distilled water to avoid mineral deposits on the wick that can change the %RH reading. The wicking distance should be as short as practical. The cotton wick must be free of any sizing and starch. The "float valve-trough" systems should also remove the water when the ambient temperature goes below freezing or above boiling.

To obtain valid %RH readings, air flow past the %RH sensor must be sufficient to evaporate the maximum amount of water from the wick without drying it out. Evaporation cools the sensor; the amount of cooling relates directly to the relative humidity present.

Thermally insulate the wet bulb sensor from the sensor mounting. This prevents mounting surface heat from flowing into the sensor sheath and changing the wet bulb temperature. (The result of such heat flow will be a humidity reading higher than actual).

Thermocouple Installation Guidelines

Locate the thermocouples in your process or system where they read average temperatures. Air flow past these sensors should be moderate. The sensors must be thermally insulated from the sensor mounting. Both thermocouples must be **ungrounded** to obtain correct readings.

Event Input and Remote Hold Input

These inputs accept a switch closure to digital common shown on Page 27.

Ground Loop - A condition created when two or more paths for electricity are created in a ground line, or when one or more paths are created in a shield.

Earth Ground - The starting point for safety and computer grounds. It is usually a copper rod driven into the earth.

Safety Ground - A ground line run with electrical power wiring to protect personnel.

Computer Ground - A ground line for the ground connections to computers or microprocessor-based systems. This line is isolated from safety ground.

Common Mode Line Filter - A device to filter noise signals present on both power line legs with respect to ground.

Differential Mode Line Filter - A device to filter noise signals present between the two power lines themselves.

The Dos and Don'ts of Clean Input Power

Do keep line filters as close to the control as possible to minimize the area for interference pick up.

Do use twisted pair wire and possibly shielded wire from line filters to the control keep the line "clean."

Do keep low power control wires physically separated as far as possible from line voltage wires. Also keep all controller wiring separate from other nearby wiring. Physical separation is extremely effective. A 12 inch minimum separation is usually effective.

Do use common mode, differential mode or a combination of the two filters wherever power may have electrical interferences.

Do cross other wiring at 90° angles whenever crossing lines is unavoidable.

Do have a computer ground line that is separate from all other ground lines. This computer ground line should ideally terminate at the ground rod where the electrical service is grounded.

Don't connect computer ground to safety ground or any other ground points in the electrical system, except at the ground rod.

Don't mount relays or switching devices close to a microprocessor control.

Don't run wires carrying line voltage with signal wires (sensor, communications or other low power lines) going to the control.

Don't use conduit for computer ground.

Don't have phase angle-fired devices in the same electrical enclosure or on the same power line with the control.

Don't connect ground to the control case if the control is mounted in a grounded enclosure (prevent ground loops).

Don't fasten common mode line filters or filters with metal cases to metal that is at ground potential. This prevents ground loops and maintains filter effectiveness.

How to Check for Ground Loops

To check for ground loops, disconnect the ground wire at the ground termination. Measure the resistance from the wire to the point where it was connected. The ohmmeter should read a high ohm value. If you have a low ohm value across this gap, there is at least one ground loop present in your system.

Also, check for continuity; your reading should be "open". If you do find continuity, you must now begin looking for the ground loops. Begin disconnecting grounds in the system one at a time, checking for continuity after each disconnection. When continuity reads "open" you have eliminated the ground loop(s). Also as you reconnect grounds, keep making the continuity test. It is possible to reconnect a ground loop.

How To Eliminate Noise

- Use "snubbers" ("QUENCHARC™") to filter out noise generated by devices such as relays, relay contacts, solenoids, motors, etc. A snubber is a simple filter device using a 0.1 μ f, 600 volt, non-polarized capacitor in series with a 100 Ω , 1/2 watt resistor. The device can be used on A.C. or D.C. circuits to effectively dampen noise at its source.
- The general purpose Watlow snubber, described above, is 0804-0147-0000. For other "QUENCHARC" sizes contact:
PAKTRON
P.O. Box 5439
Lynchburg, VA 24502
Phone: 804/239-6941
- A Metal Oxide Varistor (MOV) can be used to limit voltage "spikes" that occur on the A.C. supply lines as a result of lightning strikes, switching large motors, etc. The MOV is available in several varieties and for 115 or 230 volt lines. The device dissipates the voltage "spikes" to ground and in doing so repeatedly, deteriorates its ability to function. MOVs have a limited life.
- "Islatrols" and other similar power line filters are designed to carry the power for the control circuit and "buffer" the control circuit from A.C. line noise. Devices like the Islatrol use media (electromagnetic filtering) other than electric circuits to filter out electrical noise. Take care in matching the power capabilities of the filter with power demands of the circuit. Keep line filters as close to the control as possible to minimize the area for interference pick up.

Noise Suppression Devices Available From Watlow

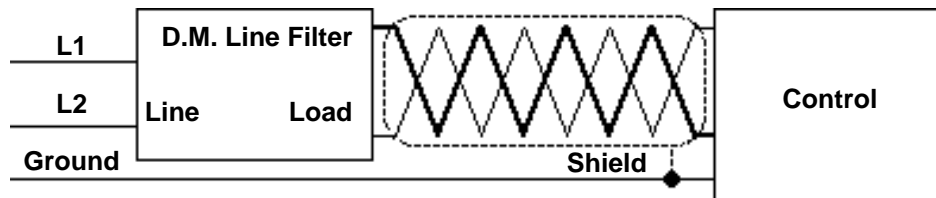
Watlow Winona stocks a few key noise suppression parts. You may order these by calling your local Watlow distributor.

Item	Electrical Ratings	Part Number
Differential Mode Line Filter	Refer to the Islatrol listing below.	
Metal Oxide Varistor	150V, 80 Joule	0802-0273-0000
MOV	275V, 75 Joule	0802-0266-0000

**Table 7 -
Noise Suppression
Device Ratings**

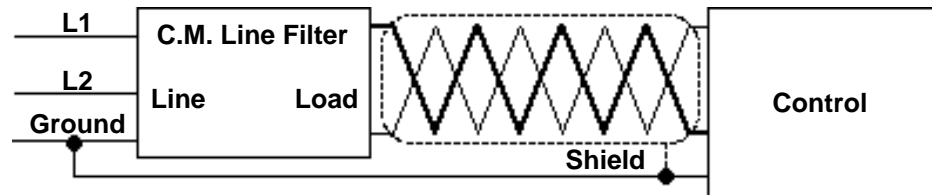
Line Filtering Configurations for Controls

These three diagrams show you filter configurations for removing input power noise. Choose the one best suited for your system if you are unsure which one to use. For very "dirty" or critical application -use microcomputer-regulated power supply or Uninterruptable Power Supply (U.P.S.)



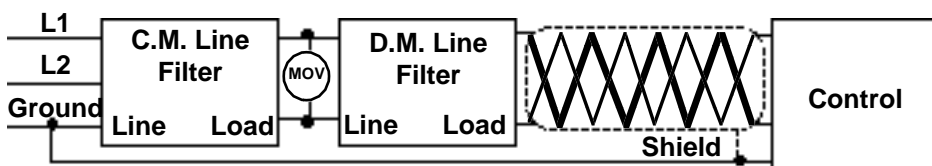
**Figure 9 -
Differential Mode
Filter Diagram**

NOTE: Keep filters 12 inches or less from the control. Minimize the line distance where noise can be reintroduced to control.



**Figure 10 -
Common Mode
Filter Diagram**

NOTE: To prevent ground loops, do not fasten common mode line filters or filters with metal cases to metal that is at ground potential. Doing so will reduce filter effectiveness.



**Figure 11 -
Combination
Differential-Common
Mode Filter Diagram**

The Series 922 mounts in a panel cutout with two brackets. These brackets hold the case against the front panel. The Series 922 behind-panel dimensions are 3.56 in. (9.05mm) high by 3.56 in. (9.05mm) wide by 6.0 in. (15.24mm) deep. Figure 12 shows the dimensions of the front panel bezel. The 922 weighs 2.75 lbs. (1.25Kg).

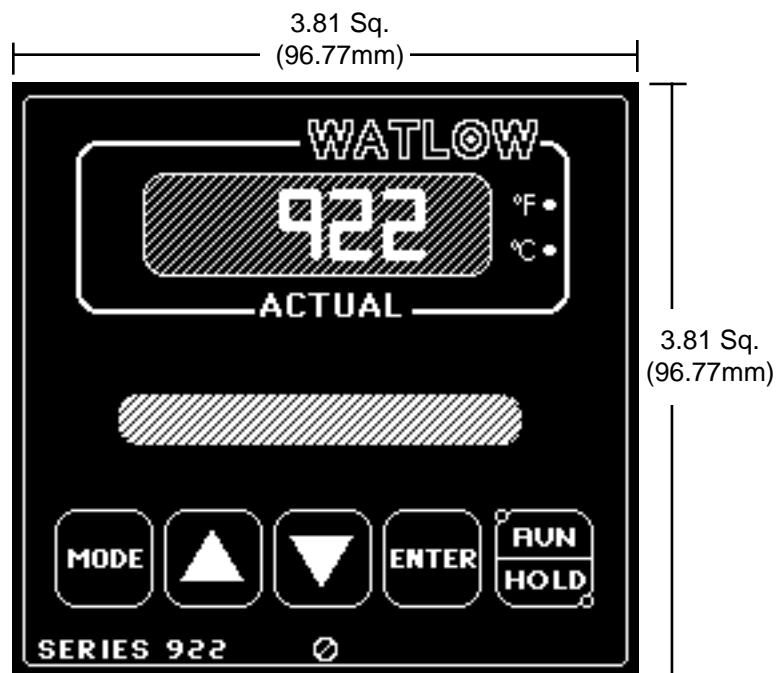
For unit dimensional and mounting information, including the location of mounting brackets and size of the front panel cutout, see Figures 13 through 15. Your panel's thickness can be from 0.06 (1.5mm) to 0.25 in. (6.3mm).

Installation Procedure

Follow this procedure to mount the Watlow Series 922 Temperature Control:

1. Make a panel cutout per the dimensions in Figure 15.
2. Remove the 922 from its case by turning the front panel screw 90° counter clockwise (CCW). Grip the bezel firmly and pull the control chassis out of the case.
3. Place the case in the cutout you just made.
4. Attach the mounting brackets either to the top and bottom, or to both sides of the unit.
5. Tighten the mounting brackets securely against your panel.
6. Insert the control chassis into its case and press the bezel to seat it. Turn the front panel screw 90° clockwise (CW) to lock the control in place. The hardware installation is complete. Go on to the wiring section from here.

CAUTION: The front panel screw turns 90° only. Do not apply excessive force or turn the screw more than 90°.



**Figure 12 -
Series 922 Faceplate
Dimensions**

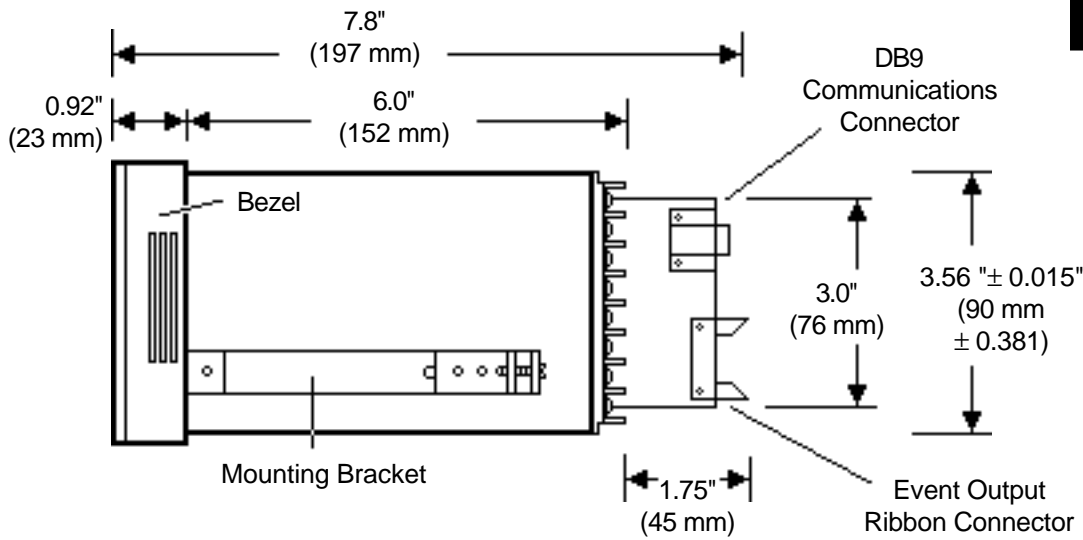


Figure 13 - Series 922 Dimensions (side view)

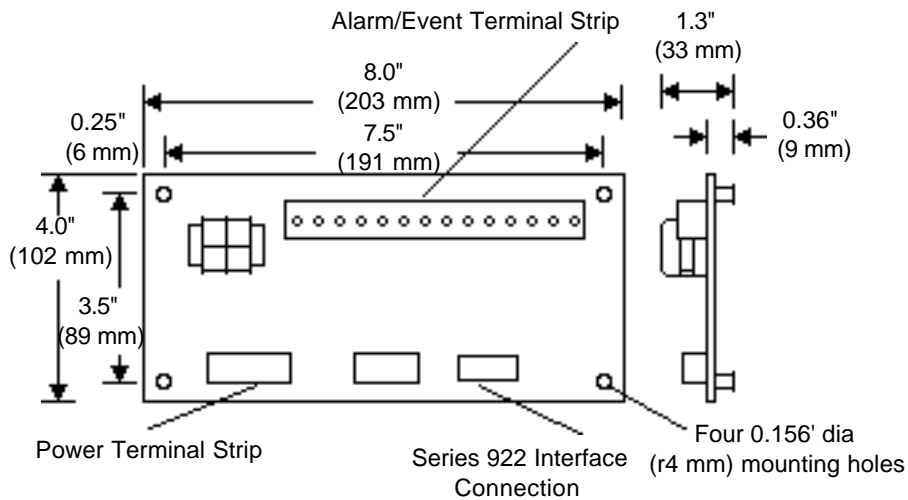


Figure 14 - External Event/Alarm Board Dimensions

See Page 33 for power wiring.

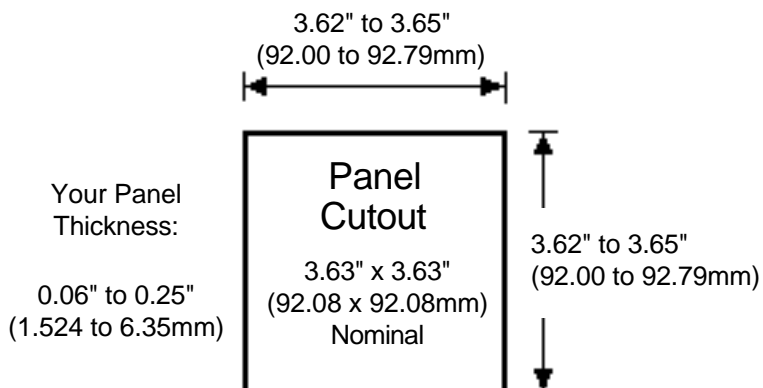
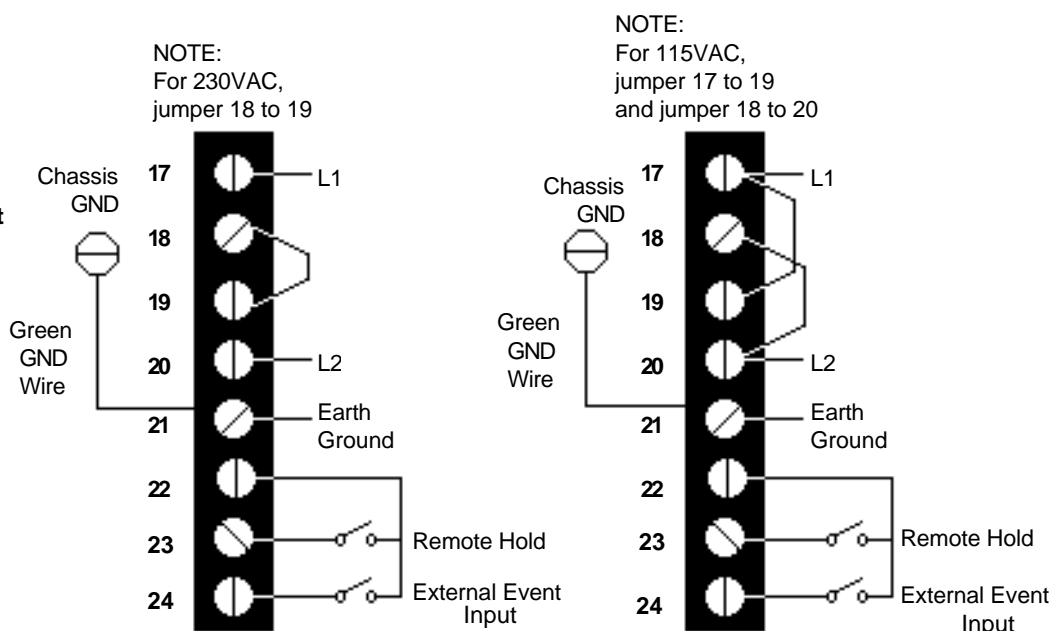


Figure 15 - Series 922 Panel Cutout Dimensions

WARNING:
To avoid potential electric shock, use National Electric Code safety practices when wiring & connecting this unit to a power source and to electrical sensors or peripheral devices.

Figure 16 - Series 922 Power Wiring Diagram.



WARNING:
To avoid electric shock, connect the chassis ground terminal to "Earth Ground."

CAUTION:
Remove the short green ground jumper on the back of the 922 (T-21) if your control is mounted in a metal panel connected to safety (chassis) ground. Removing the jumper will prevent ground loops OR leave the short green ground jumper in place if the Series 922 case is not connected to safety (chassis) ground.

Connect AC power lines and jumper wires to the power supply terminal strip of the Series 922. Study the strip connections carefully before beginning. Be sure to use these jumpers on the power supply terminal strip. For 230VAC, jumper 18 to 19. For 115VAC, jumper 17 to 19 and jumper 18 to 20.

All wiring and fusing must conform to the National Electric Code and to any locally applicable codes also.

Before applying power, open the Series 922 and set DIP Switch #1 in the "ON" position for a Cold Start. Replace the control chassis in the enclosure. Apply power to the unit. (This clears all previously entered information from the 922; it is a "clean" or "cold" start).

Now remove power again, open the unit, and set Switch #1 to OFF. (This makes the next start a "warm" one, retaining all subsequently entered information in the processor's memory). Close the 922.

When applying power without sensor inputs on the Signal Conditioner terminal strip, or if the control is not configured for the correct sensor input, the Series 922 alternately flashes from SYSTEM to ER1 00XX. This is an error code indicating an open sensor. These are normal displays for a unit without sensors or improper configuration.

For more information on remote hold and external event input refer to page 38.

How to Wire the Series 922

This section has all the information you need to complete a good wiring job on the Series 922 and your system. Please read the Safety Information in the narrow column on the outside of each page. You will find internal circuits on the left in the following diagrams, and external circuits on the right. In addition, input and output options are listed by model number. Refer to the unit sticker on your control to be sure that you are wiring from the corresponding diagram. We suggest that you read through the entire section before beginning your hookup. Then proceed, starting with the sensor inputs, auxiliary outputs, then control outputs, data communications, and finally, power wiring.

It is very important to enter a system set point in the Series 922 before applying power to the load circuitry.

- In all wiring diagrams, internal circuits are on the left and external circuits are on the right.

WARNING: To avoid electric shock, make all connections on the back of this control before connecting power to the control. Also disconnect power before opening the Series 922. Do not apply load power to the output circuits until you have entered a system set point.

Input Option "1" or "6", Terminals 1 - 8

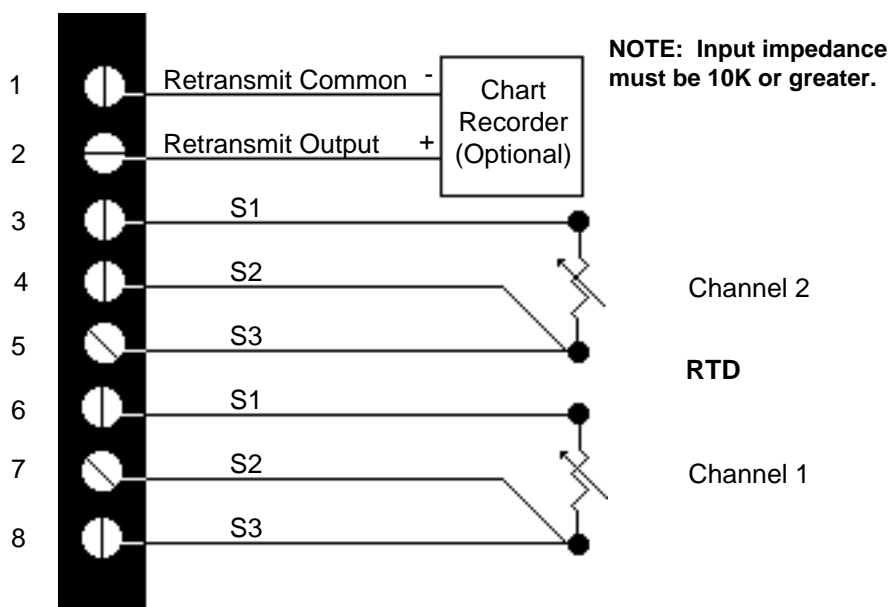


Figure 17 - Input Option "1", Dual RTD, Wiring Diagram.

NOTE: For a two-wire RTD -
Channel 2:
Use Terminals 3 and 4 for RTD, and jumper Terminal 5 to Terminal 4.

Channel 1:
Use Terminals 6 and 7 for RTD, and jumper Terminal 8 to Terminal 7.

Wire Input

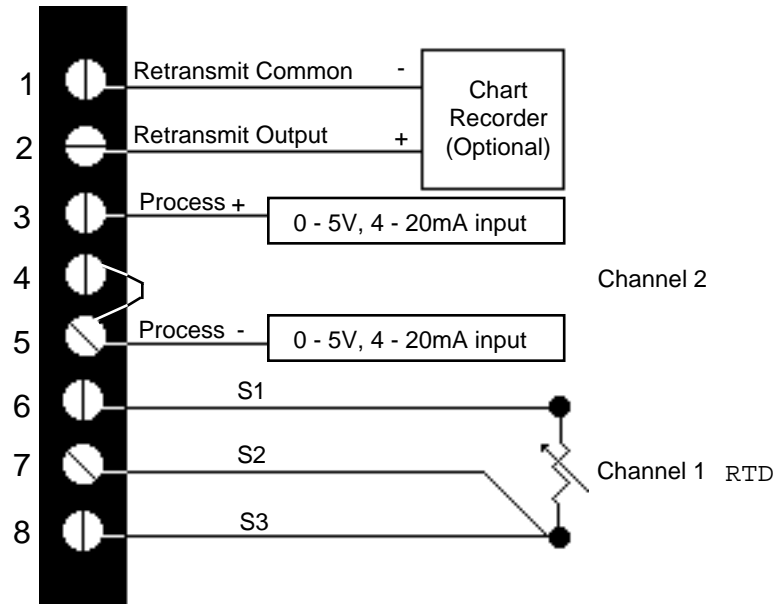
Input Options "2" & "7", Terminals 1 - 8

Model # 922A - 2 _ _ 0 - _ 000 &

Model # 922A - 7 _ _ 0 - _ 000

Figure 18 -
Input Options
"2" & "7",
RTD/Process,
Wiring Diagram.

NOTE: For a two-
wire RTD - Channel
1: Use Terminals 6
and 7 for RTD, and
jumper Terminal 8 to
Terminal 7.



NOTE: Jumper
terminal 4 to 5 only
when using 4-20mA
input.

Input Option "3", Terminals 1 - 8

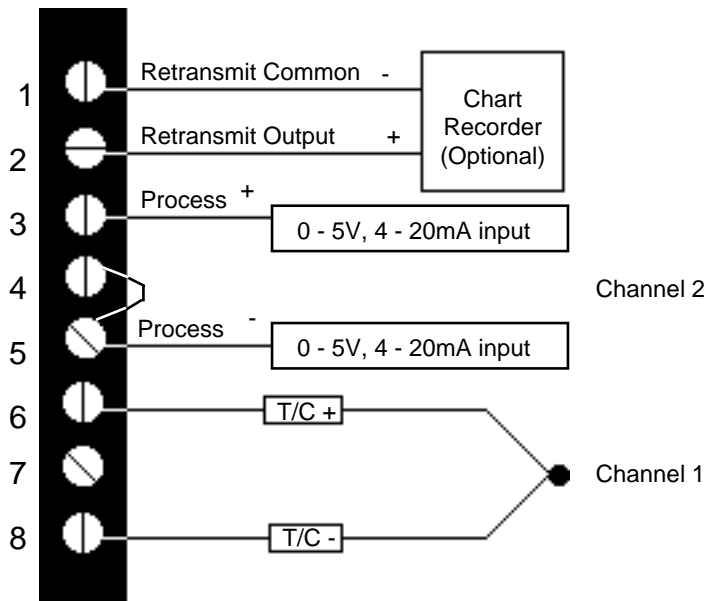
Model # 922A - 3 _ _ 0 - _ 000

Model # 922A - A _ _ 0 - _ 000

Model # 922A - B _ _ 0 - _ 000

Input Impedance:
4-20mA = 250
0-5V = 100K

Figure 19 -
Input Option
"3", "A", or "B"
T/C and Process,
Wiring Diagram.



Input Option "4", Terminals 1 - 8

Model # 922A - 4 _ _ 0 - _ 000

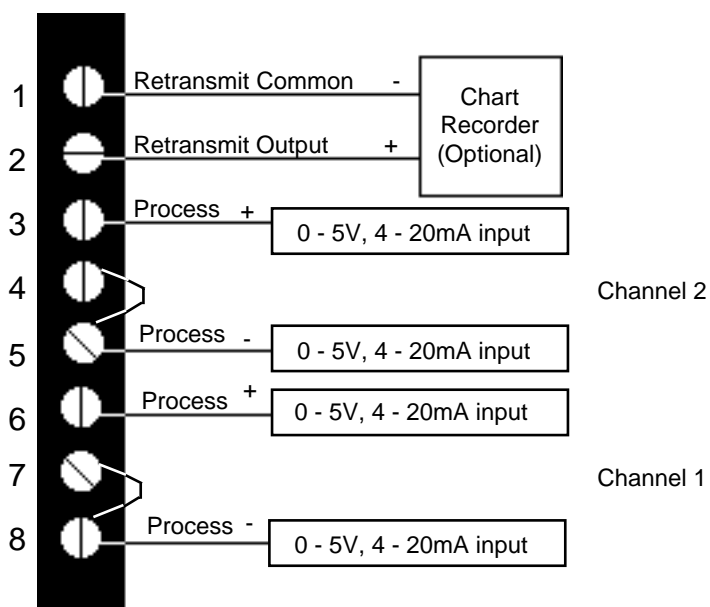


Figure 20 -
Input Option "4"
Dual Process,
Wiring Diagram.

NOTE¹: Jumper
terminal 4 to 5 only
when using 4-20mA
input for Channel 2.

NOTE²: Jumper
Terminals 7 to 8
when using
4 - 20mA input for
Channel 1.

Input Option "5", Terminals 1 - 8

Model # 922A - 5 _ _ 0 - _ 000

Model # 922A - 8 _ _ 0 - _ 000

Model # 922A - 9 _ _ 0 - _ 000

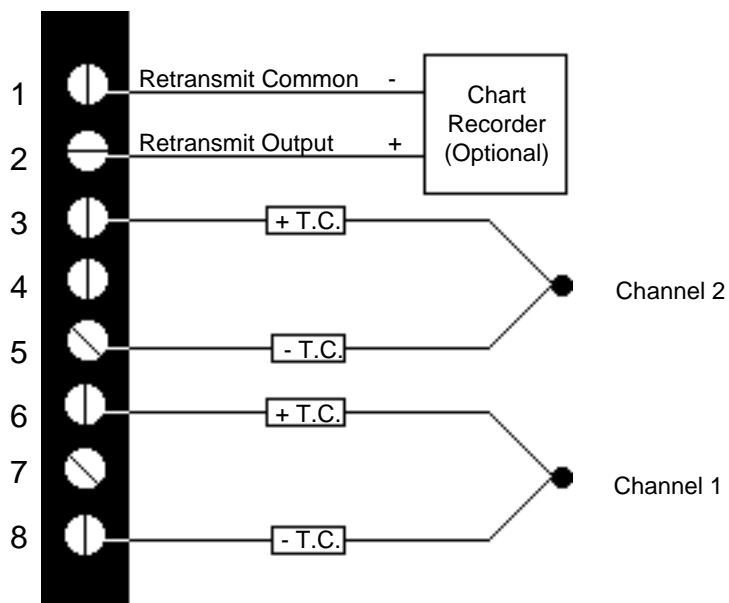


Figure 21 -
Input Option
"5", "8", or "9"
Dual T/C,
Wiring Diagram.

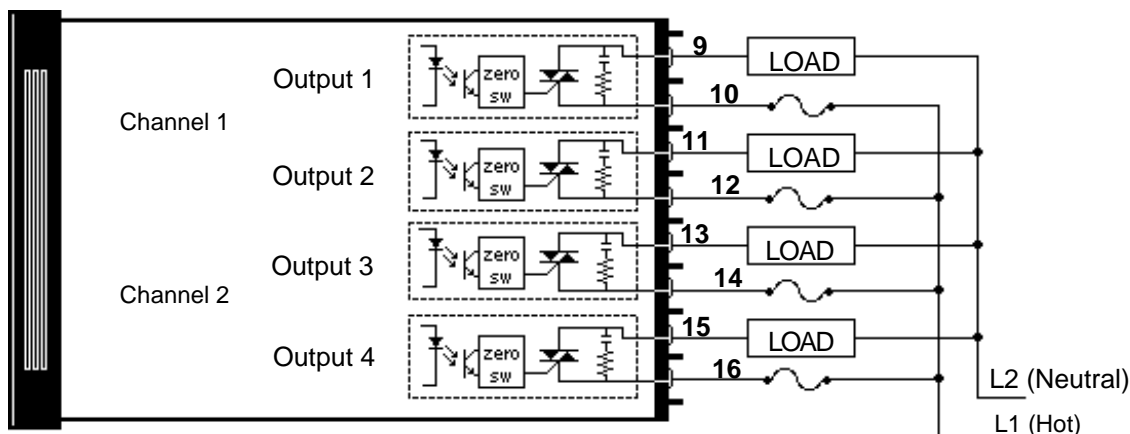
WARNING:
Use ungrounded
sensor for proper
operation.

Wire Output

Output Option "BB", Dual Solid State Relay

Model # 922A - _ BB _ - _ 000

Figure 22 - Dual S.S. Relay Output, Option "BB", Wiring Diagram.

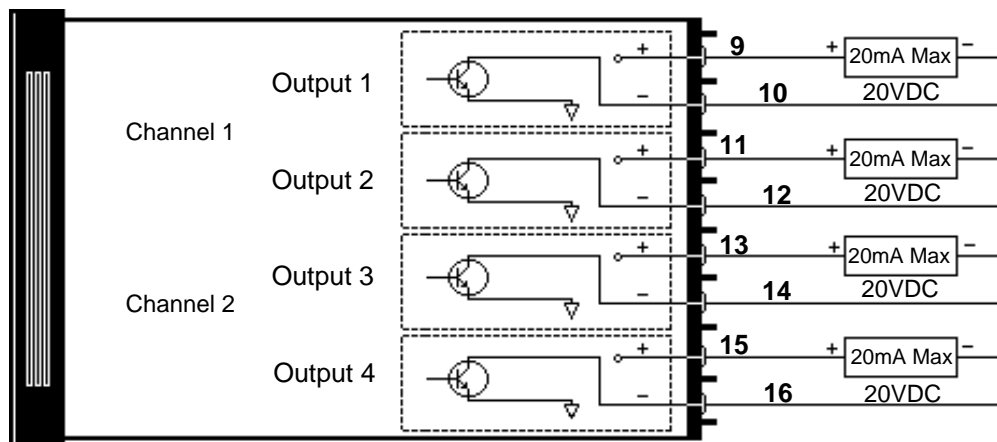


Output Option "CC", Solid State Switch

Model # 922A - _ CC _ - _ 000

Figure 23 - Solid State Switch, Option "CC", Wiring Diagram.

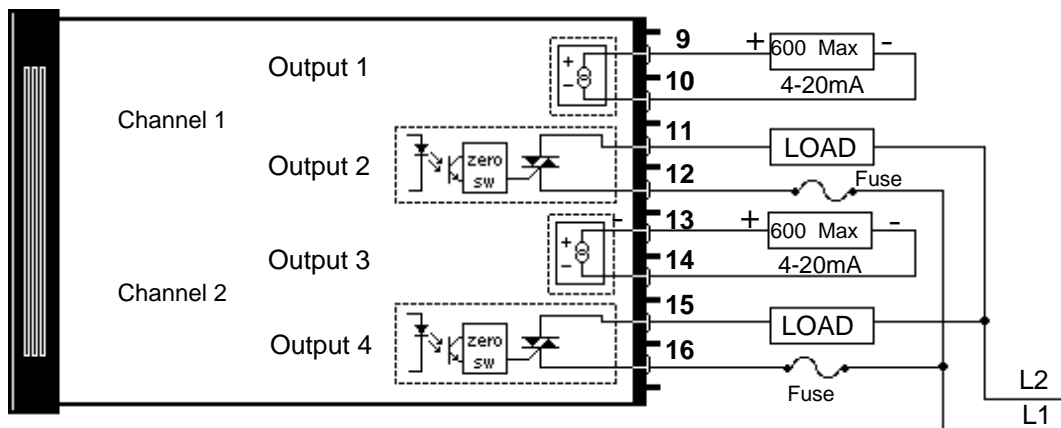
NOTE: If SPCLFUNC parameters OUT 1 and/or OUT2 are set to CL HT, then Outputs 1 and/or 3 will be the cooling output and Outputs 2 and/or 4 will be the heating outputs.



Output Option "FB", 4-20mA/ Solid State

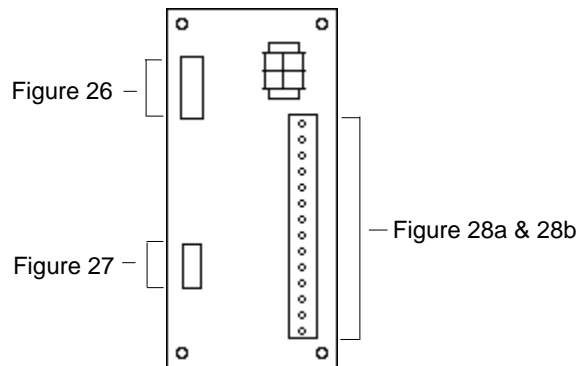
Model # 922A - _ FB 0 - _ 000

Figure 24 - 4-20mA/Solid State Output, Option "FB", Wiring Diagram.

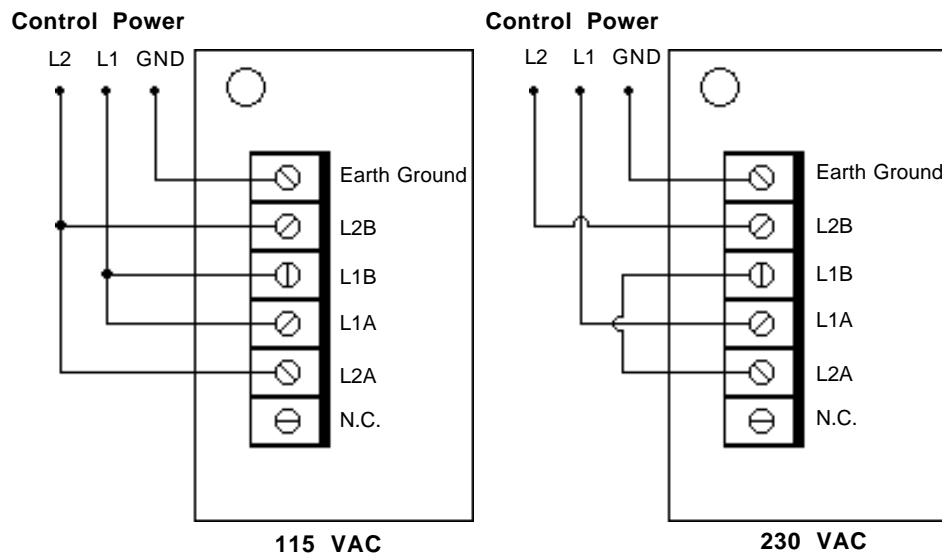


Use the following figures to learn the connections and wiring of the External Event/Alarm Board. Refer to Page 27 for dimension and mounting information.

Event Board



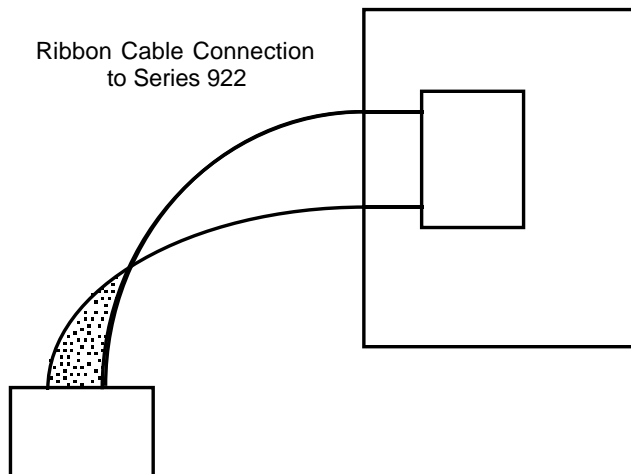
**Figure 25 -
External Event/
Alarm Board
Information.**



**Figure 26 -
External Board
Control Power
Wiring.**

An auxiliary power supply is available on the Series 922 event board to supply DC voltage needed to operate the Vaisala Model HMM 30C RH sensor or other transmitters or transducers. The supply voltage varies from 21 to 33VDC, with the maximum current output of 25mA.

External Event Board to Series 922 Connection



**Figure 27 -
Ribbon Cable
Connector to
Series 922.**

Event Board

Event Output Option "B" and "K", Solid State Relay 0.5A @ 24V~ (VAC) Min., 253V~ (VAC) Max.

NOTE: Check model number for appropriate diagram.

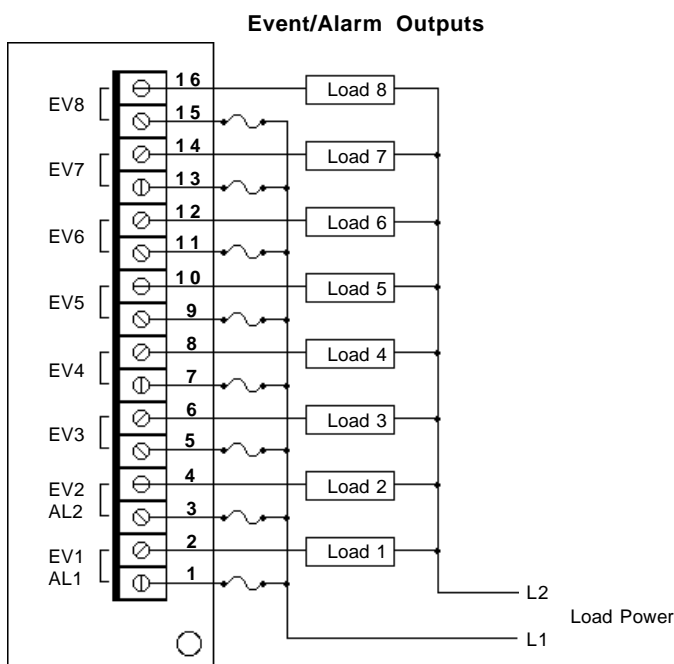
Model #A007-1732-XXBX

With RC Suppression.
Minimum OFF-state impedance 20K .

Model #A007-1732-XXKX

Without RC Suppression.
Minimum OFF-state impedance 31M .

**Figure 28 -
Event Option "B"
and "K," Solid State
Relay**

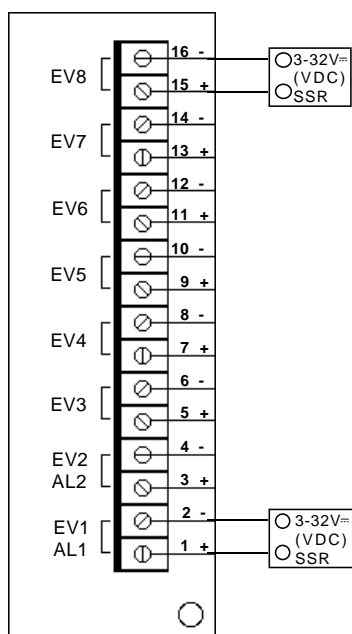


**Figure 28a -
Event Option "C"
Switched DC**



CAUTION: If AC load is connected to "C" option output, damage may occur to event board and to 922.

Event Output Option "C", Switched DC Model #A007-1732-XXCX



Single Phase 120VAC Application

Wiring Example

WARNING:

Install High or low temperature limit control protection in systems where an overtemperature or undertemperature fault condition could present a fire hazard or other hazard. Failure to install temperature limit control protection where a potential hazard exists could result in damage to equipment and property, and injury to personnel.

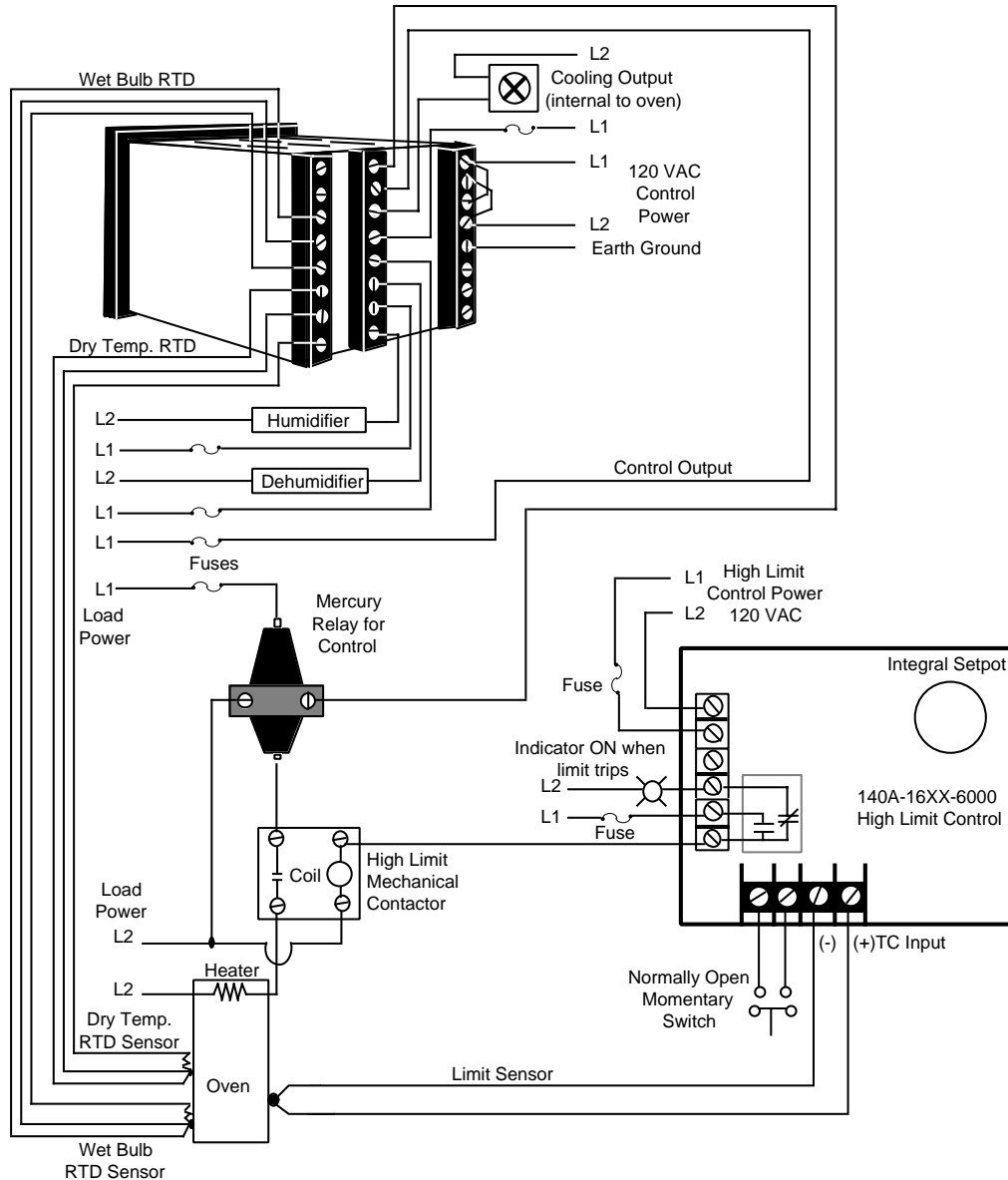


Figure 29 -
Series 922 System
Wiring Example.

WARNING: With Watlow mercury relays, load must have a unity power factor. For RESISTIVE LOADS ONLY.

Chapter 5

How to Tune the Series 922

This chapter will explain tuning the 922 to the system it controls.

Recommended Tuning Reference

There are a number of quality references on the art of tuning electronic controllers to the systems they control. If you are not an instrument technician qualified to tune thermal systems, we suggest that you obtain and become familiar with the reference below before attempting to tune your system. Remember that the time you spend tuning your system is relative to the quality of control you need.

Tuning of Industrial Control Systems

Armando B. Corripio

Published by the Instrument Society of America

Using A Chart Recorder

The tuning procedure will be greatly simplified if you use a chart recorder to assist in tuning the Series 922. Connect the chart recorder to the analog retransmit signal.

The analog retransmit signal provides a chart recorder output represented by C1 or C2 (Actual process variable), or SP1 or SP2 (Set Point temperature). The user selectable scaling factors are 1, 2, 5, or 10mV per least significant digit.

If you don't have a chart recorder available, you can still plot the time vs. temperature system response. Record the 922's ACTUAL display readings on graph paper with an x, y axis to accomplish the same thing.

For optimum control performance, tune the 922 to the thermal system. The tuning settings here are meant for a broad spectrum of applications; your system may have somewhat different requirements. Refer to the key flow charts, diagrams and definitions on Pages 42 - 61 for prompt location and description. **Repeat this tuning procedure for both Channel 1 and 2.**

NOTE:

When tuning in the Heat mode, use PID prompts followed by H.

When tuning in the Cool mode, use PID prompts followed by C.

1. **Apply power to the Series 922** and enter a set point in the SYSTEM, menu. Next, go into the SETUP mode, and enter ACCESS (1), the SPCLFUNC (Special Function) parameter. Using the MODE, UP/DOWN, and ENTER keys, set the Operating Parameters initially: (Proportional Band) PB_H (C) = 0, (Reset) RS_H (C) = 0.00, (Rate) RT_H (C) = 0.00, (Cycle Time) CT_H (C) = 5. Under ACCESS (0) enter CAL_ = 0.

Allow actual process temperature to stabilize at or near Set Point (SP). The ACTUAL display will indicate when the load is stabilized near setpoint.

2. **Proportional Band Adjustment:** Gradually increase PB until the ACTUAL display temperature stabilizes to a constant value. The temperature will not be right on set point because the initial reset value is 0.00 repeats per minute. The ACTUAL temperature will stabilize below the desired setpoint. (When PB = 0, RS, RT, and CT are inoperative, and the 922 functions as a simple ON/OFF control with a 3°F or 1.7°C switching differential.)
3. **Reset Adjustment:** Gradually increase RS until the ACTUAL display temperature begins to oscillate or "hunt". Then slowly decrease RS until the ACTUAL display stabilizes again near set point NOTE: This is a slow procedure, taking from minutes to hours to obtain optimum value.
4. **Cycle Time Adjustment:** Set CT as required. Optimum system control is always achieved with faster cycle times. However, if a mechanical contactor or solenoid is switching power to the load, a longer cycle time may be desirable to minimize wear on the mechanical components. Experiment until the cycle time is consistent with the quality of control you want.
5. **Rate Adjustment:** Increase RT to 0.10 min. Then raise SP by 20° to 30°F, or 11° to 17°C. Observe the system's approach to SP. If the load temperature overshoots SP, increase RT to 0.20 minutes.

Then raise SP by 20 to 30°F, or 11 to 17°C and watch the approach to the new set point. If RT is advanced too far, approach to the set point will be very sluggish. Repeat as necessary until the system rises to the new set point without overshooting or approaching the set point too slowly.

6. **Calibration Offset Adjustment:** You may want your system to control to a temperature other than the value coming from the input sensor. If so, measure the difference (as much as ±90°F or ±50°C) between that temperature, perhaps at another point in the system, and the process value showing in the alphanumeric display. Then enter the amount of CAL offset you want. Calibration offset adds or subtracts degrees from the value of the input signal.

After you have tuned your Series 922, continue to Chapter 6 to learn how to Program your Series 922 for your system.

Chapter 6

How To Program The Series 922

This chapter enables you to setup the Series 922 quickly and easily. It explains why it's a good idea to write out your parameter values. Chapter 6 also shows you flow diagrams of the programming process.

Write Out Your Program

The Watlow Series 922 controls temperature for a specific heating and/or cooling process. Your setup parameter values, when they're entered, give the Series 922 orders for the work you want it to perform.

Since the amount of information in the setup is extensive, we suggest that you write the value on a **copy** of the Master Step Chart on Page 62. This enables you to program the Series 922 quickly and without mistakes. The chart makes a good record of your values.

Select the Proper DIP Switch Settings

Prior to programming, and operating the Series 922, you must set the DIP Switches.

DIP Switch #1 sets a "warm" or "cold" start following power removal from the 922. With the DIP switch in the OFF position for a "Warm Start", the microprocessor uses previously programmed information as if power had not been removed. A Cold Start starts "clean" or completely cleared of all user-programmed information when the DIP switch is in the ON position. All parameters are empty or set to the default limits.

DIP Switch #2 in the ON position displays only certain factory selected SPCLFUNC parameters. Set the DIP Switch in the OFF position to display all parameters.

DIP Switch #3 selects tenths of units displayed for process inputs.

DIP Switch #4 is ON for 0-5VDC/0-20mA input & OFF for 1-5VDC/4-20mA input.

DIP Switch #5 is not used. Set it to the OFF position.

DIP Switch #6 is for factory test and calibration, it must be OFF.

External Event Input

The event input allows the Series 922 to be programmed to wait at that point in the profile until a change in status of the event input occurs. It can be programmed to wait for a switch closure or opening at Terminals 22 and 24 via the WE (wait for event) step in the WAITFOR menu.

Remote Hold Input

A contact closure across the remote hold input (terminals 22 & 24) causes the Series 922 to pause until the switch opens. This is indicated by a flashing RUN LED. While in this condition, the 922 actively maintains the set point and event output conditions which exist.

Another feature of the Series 922 is its capability for up to eight event outputs via an external event output board. You have the option of ordering your 922 without events, or adding an external board for two or eight outputs. An "event output" is simply a pre-programmed ON/OFF event per program step. The event may turn any number of peripheral devices ON or OFF to assist you in controlling your process, system or environment.

For instance, in an environmental chamber, you might wish to circulate air at a given time in your program for one or more steps. You may want to turn lights ON or OFF, or signals, lock out your humidifier, or activate a video recorder.

EV1 and EV2 are not visible under the SYSTEM menu until you select AUX1 & AUX2 as events in the SETUP menu, and the two or eight event output board is connected.

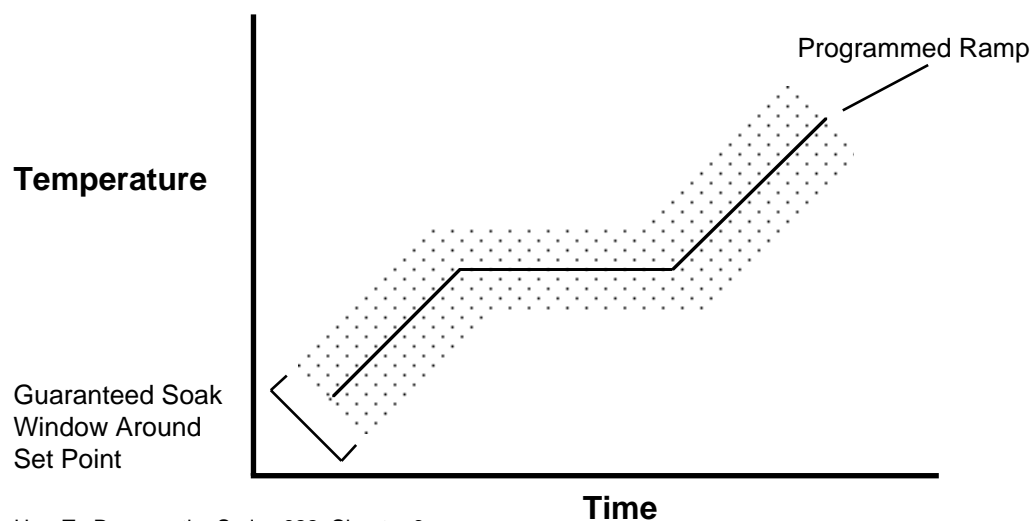
Enter the SETUP menu, and enter ACCESS (5). This is the SPCLFUNC (Special Function) parameter. Press the MODE key until you reach the AUX1 parameter and press ENTER. The default for AUX1 and AUX2 is AL (Alarms). Change the value to EV (Events) if it hasn't already been done.

If you return to the SYSTEM menu, EV1 and EV2 are visible, and can be turned ON or OFF from here. EV1 and EV2 can also be viewed under the SETPOINT parameter in the PROGRAM menu. EV3 through EV8 are not displayed unless you have the 8 event output board connected. See the Model Number Information on Page 70 for ordering information.

If the events are programmed for one step and left unprogrammed for the next step, the events maintain the last programmed status. These event outputs are solid state relays rated at 0.5 amps up to 240VAC.

Guaranteed Soak

The Series 922 Guaranteed Soak (GS) feature insures that the process temperature tracks a programmed ramp. The Guaranteed Soak acts as a deviation alarm. The program clock halts if the ACTUAL temperature exceeds the Guaranteed Soak value. At this time the HOLD LED flashes. The clock starts once the process variable is within the GS deviation value. Programmed in degrees or process units, GS is in the SETUP menu under ACCESS (5). Entering a value of (0) disables the Guaranteed Soak function. **The Guaranteed Soak function only applies to Channel 1.** Figure 30 is an example of the Guaranteed Soak function.



**Figure 30 -
Guaranteed Soak
(GS) Example**

NOTE: If the program is put in the HOLD mode while holding for a guaranteed soak, and restarted at another step, the GS has to be met for the previous step, before the program can continue.

Jumploops

The Four JUMLOOP Types

The Series 922 gives you the capability to perform four basic jumploop types in your programming. The backward jump, forward jump, nested loops, and intertwining loops. **These are only definitions of the four loops.** The Series 922 has very few rules concerning loops in your program.

Backward Jump

The **Backward** jump is the most common jump. A backward jump will force you to a step already performed. The Jump Step (JS) must be less than the current step. You cannot JUMLOOP to the step that you are on.



The steps in sequence will be: 2, 3, 4, 5, 2, 3, 4, 5, 6.

Your Jump Count (JC) can be anything from 0 - 100. If you enter 0, this will be an infinite loop and will never progress to Step 6.

Forward Jump

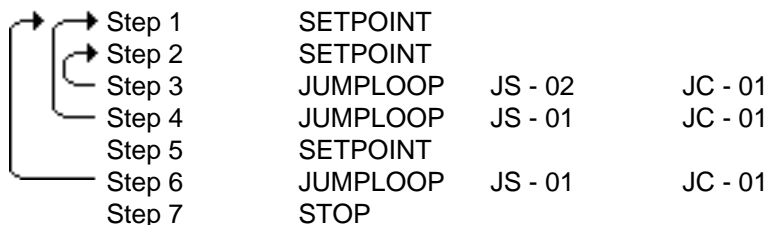
The next loop type is a **Forward** jump. By definition you can jump forward. The Jump Step must be greater than this step.



The steps in sequence will be: 1, 2, 3, 5.

Nested Loop

A **"Nested"** loop is a jump loop within a loop. You are forced to a step either forwards or backwards from your present location. When nested loops are performed, they cannot break across other loops. Your JC can be from 0 - 100 with 0 being an infinite looping.



The steps in sequence will be: 1, 2, 3, 2, 3, 4, 1, 2, 3, 2, 3, 4, 5, 6, 1, 2, 3, 2, 3, 4, 1, 2, 3, 2, 3, 4, 5, 6, 7.

Intertwined Loop

An **"Intertwined"** loop can break across other loops.



The steps in sequence will be: 1, 2, 3, 1, 2, 3, 4, 2, 3, 1, 2, 3, 4, 5.

Rules to Follow

The one basic rule that you must follow is that you can only have a maximum of three consecutive jump loops.



Your program will run until it reaches Step 5, and flashes an ER2 0039. This is the infinite looping error, and means you have too many consecutive loops.

Another rule to follow is you cannot JUMLOOP to a step you are on. You'll receive an ER2 0039. Clear the error in the ER2 parameter under the SYSTEM menu and retransmit your data.

Use simple loops in your program!

SYSTEM Menu

The next pages will show you each of the Series 922 menus and their prompts and values. Each section, SYSTEM, SETUP, and PROGRAM, has a menu graphic with a table of values, followed by prompt definitions. Don't write in the tables and charts here, but make copies to document your control.

Prompt definitions are also listed in the glossary.

Programming in General




Programming the Series 922 is easy as 1 - 2 - 3:

1. Use the MODE key to select the alphanumeric display prompt you want.
2. Use the UP/DOWN keys to select data or prompts in the alphanumeric display.
3. Press ENTER.

SYSTEM Menu

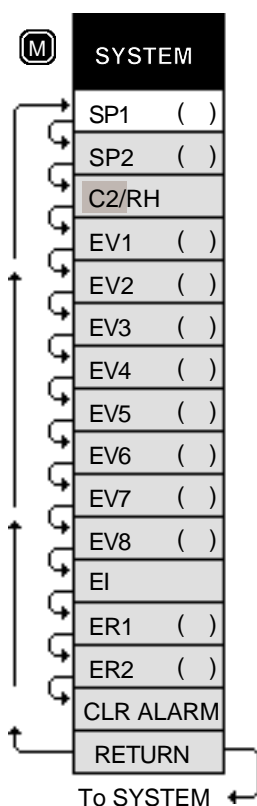
The SYSTEM mode has the capability to generate a non-ramping set point and manipulate events. You can also clear alarms and error codes from this menu. Step through the SYSTEM menu using the key flow diagram and table below.

Graphics Key





-  = MODE Key
 = ENTER Key
 = UP/DOWN Key



NOTE: Shaded parameters may not appear on your control. These parameters are dependent on how your control is configured. See Pages 43 - 44 for more information.

Figure 31 -
SYSTEM Key Flow



Press  to enter SYSTEM menu.

After selecting a value with the   keys, press  . Continue to the next parameter by pressing  .

At any RETURN, you can press  to return to SYSTEM, **or** press  to return to the first parameter.

**Table 8 -
SYSTEM Prompts and
Description**

Make photocopies, keep original clean.

SYSTEM Menu

SYSTEM				
Prompt	Description	Range	Default	Your Settings
SP1	Monitor/Enter CH 1 Fixed Set Point value.	TEMP: R1L and R1H PROC: A1L and A1H	73°F/23°C 73.4°F/23.0°C	
SP2	Monitor/Enter CH 2 Fixed Set Point value. Dependent on "TYP" under SPCLFUNC.	TEMP: R2L and R2H PROC: A2L and A2H	73°F/23°C 73.4°F/23.0°C	
C2/RH	Displays CH 2 actual process variable. Dependent on "TYP" under SPCLFUNC.	--	--	
EV1	Monitor/Enter the Event Output 1 status. Dependent on AUX1 = EV & output board.	OFF or ON	OFF	
EV2	Monitor/Enter the Event Output 2 status. Dependent on AUX2 = EV & output board.	OFF or ON	OFF	
EV3	Monitor/Enter the Event Output 3 status. Dependent on 8 event output board.	OFF or ON	OFF	
EV4	Monitor/Enter the Event Output 4 status. Dependent on 8 event output board.	OFF or ON	OFF	
EV5	Monitor/Enter the Event Output 5 status. Dependent on 8 event output board.	OFF or ON	OFF	
EV6	Monitor/Enter the Event Output 6 status. Dependent on 8 event output board.	OFF or ON	OFF	
EV7	Monitor/Enter the Event Output 7 status. Dependent on 8 event output board.	OFF or ON	OFF	
EV8	Monitor/Enter the Event Output 8 status. Dependent on 8 event output board.	OFF or ON	OFF	
EI	Displays status of the external event input.	OPEN or CLOSE	Open	
ER1	Displays/Clears the most recent fatal error.	0 - 18	-	
ER2	Displays the most recent nonfatal error.	0 - 40	-	
CLR ALARM	Displays the current alarm.	1 High, 1 Low 2 High, 2 Low	-	
RETURN	Press the ENTER key to return to the SYSTEM prompt. Press the MODE key to return to the SP1 prompt.			

Shaded parameters may not appear on your control. They are dependent on your control configuration.

SYSTEM

One of three main level operating menus. From the SYSTEM menu, you can generate a non-ramp set point (fixed), manipulate Events 1 through 8 ON or OFF, clear system errors, and clear latching alarms.

SP1 ()

Represents the current set point for Channel 1.

Range: R1L and R1H

Default: 73°F/23°C (whole) 73.4°F/23.0°C (tenths)

SP2 ()

Represents the current set point for Channel 2. SP2 will not appear if TYP, under the SPCLFUNC menu, is set up for "T" (Temperature for Channel 1 only) or for "P" (Process for Channel 1 only).

Range: R2L and R2H

Default: 73°F/23°C (whole) 73.4°F/23.0°C (tenths)

C2/RH

Represents the current value of the process variable from the sensor inputs for Channel 2. C2 will not appear if TYP, under the SPCLFUNC menu, is set up for "T" (Temperature for Channel 1 only) or "P" (Process for Channel 1 only). RH only appears if TYP = T H, T V, or P V.

SYSTEM Menu

EV1 ()

This auxiliary output can be an alarm or event. Events may be turned ON or OFF in the HOLD mode. EV1 will only appear when AUX1 = EV, under the SPCLFUNC menu, and when the external event output board is connected.

Range: OFF or ON

Default: OFF

EV2 ()

This auxiliary output can be an alarm or event. Events may be changed ON or OFF in the HOLD mode. EV2 will only appear when AUX2 = EV, under the SPCLFUNC menu, and when the external event output board is connected, or when TYP = "T" or "P" and an external event board is connected.

Range: OFF or ON

Default: OFF

EV3 ()

EV4 ()

EV5 ()

EV6 ()

EV7 ()

EV8 ()

These auxiliary outputs are events. Events may be turned ON or OFF in the HOLD mode. EV3 through EV8 only appear when the 8 event output, external board is connected.

Range: OFF or ON

Default: OFF

EI

EI monitors the status of the external event input. OPEN will be displayed if the external event input is open, or will display CLOSE if terminals 22 and 24 are tied together. This is a switch input, not voltage or current.

Range: OPEN or CLOSE

Default: OPEN if nothing is connected to the input.

ER1 ()

ER1 is considered a fatal error; your system will shut down. When the Series 922 shuts down, all outputs will be turned off, and the program will stop running. When an error occurs, ER1 00XX will alternately flash with the SYSTEM parameter. To clear an error, ENTER the SYSTEM mode, and scroll to the ER1 parameter. Press ENTER. This clears the error unless it is a re-occurring error and has not been resolved. Some ER1 errors are self clearing.

Range: 0 - 18

ER2 ()

ER2 is considered nonfatal. If you are in the RUN mode, your program will continue running unless it is a program error. ER2 00XX appears, and flashes alternately along with the parameter that you are on. To clear an ER2, return to the ER2 parameter under the SYSTEM mode. Press ENTER. If the error persists, refer to the Error Code list at the end of the manual to clear.

Range: 0 - 40

CLR ALARM

Alarms 1 and 2 are considered nonfatal. If you are in the RUN mode, your program will continue to run. ALMX XX appears and flashes alternately with the parameter you are presently on. ENTER the CLR ALARM parameter to clear a latching alarm. A non-latching alarm clears itself once it falls within the alarm limits.

Range: 1 High, 1 Low, 2 High, 2 Low

RETURN

From any RETURN, you can go back to SYSTEM prompt.

SETUP Menu




SETUP Menu

While in the HOLD mode, press the MODE key until you see SETUP, press ENTER. These parameters are to setup the personality of your Series 922. Using the MODE to progress through the prompts, use the UP/DOWN keys to select parameters and values and press ENTER.

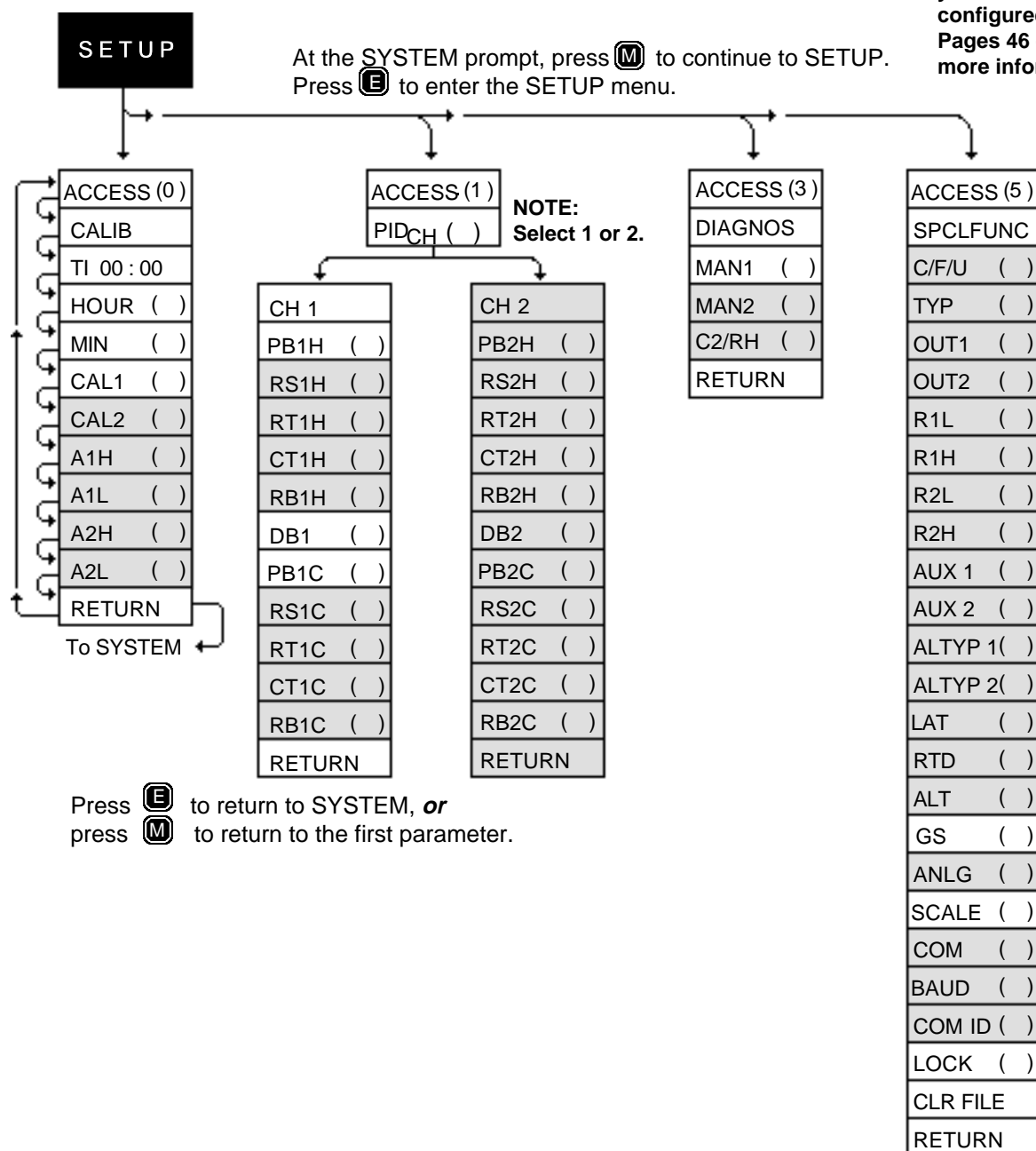
Select each ACCESS number. Follow that parameter sequence to enter values. You must return to SYSTEM before you can continue to the next ACCESS number.

**Figure 32 -
SETUP Key Flow**

Graphics Key

-  = MODE Key
-  = ENTER Key
-  = UP/DOWN Key

NOTE: Shaded parameters may not appear on your control. These parameters are dependent on how your control is configured. See Pages 46 - 56 for more information.



SETUP Menu

**Table 9 -
SETUP Prompts and
Description.**

Make photocopies, keep original clean.

SETUP				
Prompt	Description	Range	Default	Your Settings
	ACCESS = (0) CALIB To enter CALIB parameters use ACCESS (0) and ENTER.			
TI XX:XX	Read only. Displays the Real Time. HH:MM			
HOURL	Enter the hours to display the system time-of-day clock.	0-23 hours	0	
MIN	Enter the minutes to display the system time-of-day clock.	0-59 minutes	0	
CAL1	Enter the Calibration Offset value for Channel 1.	-90 to 90°F/-50 to 50°C -9.0 to 9.0°F/-5.0 to 5.0°C/U	0	
CAL2	Enter the Calibration Offset value for Channel 2. Dependent on TYP parameter.	-90 to 90°F/-50 to 50°C -9.0 to 9.0°F/-5.0 to 5.0°C/U	0	
A1H	Enter the Alarm 1 High value. Displayed if AUX1 = AL. Dependent on AUX1 and ALTYP1 parameters.	See below.		
A1L	Enter the Alarm 1 Low value. Displayed if AUX1 = AL. Dependent on AUX1 and ALTYP1 parameters.	See below.		
A2H	Enter the Alarm 2 High value. Displayed if AUX2 = AL. Dependent on AUX2, ALTYP2, and TYP parameters.	See below.		
A2L	Enter the Alarm 2 Low value. Displayed if AUX2 = AL. Dependent on AUX2, ALTYP2, and TYP parameters.	See below.		
RETURN	Press the ENTER key to return to the SYSTEM prompt. Press the MODE key to return to the CALIB prompt.			

	Range	Process Default & High Slew Limit	Deviation Default		Range	Process Default & Low Slew Limit	Deviation Default
AXH	J	1382°F/750°C	999°F/555°C/U	AXL	J	32°F/0°C	-999°F/-555°C/U
	K	2282°F/1250°C	999°F/555°C/U		K	-328°F/-200°C/U	-999°F/-555°C/U
	T	662°F/350°C	999°F/555°C/U		T	-328°F/-200°C	-999°F/-555°C/U
	% RH	100%	555		% RH	0%	-555
	RTD Whole	1112°F/600°C	999°F/555°C/U		RTD Whole	-328°F/-200°C	-999°F/-555°C/U
	RTD Tenths	392.0°F/200.0°C	999°F/555°C/U		RTD Tenths	-99.9°F/-99.9°C	-999°F/-555°C/U
	0 - 5 Whole	1985°F/1985°C	999°F/555°C/U		0 - 5 Whole	-117°F/-117°C	-999°F/-555°C/U
	0 - 5 Tenths	198.5°F/198.5°C	999°F/555°C/U		0 - 5 Tenths	-11.7°F/-11.7°C	-999°F/-555°C/U
	4 - 20 Whole	1985°F/1985°C	999°F/555°C/U		4 - 20 Whole	-285°F/-285°C	-999°F/-555°C/U
	4 - 20 Tenths	198.5°F/198.5°C	999°F/555°C/U		4 - 20 Tenths	-28.5°F/-28.5°C	-999°F/-555°C/U

Prompt	Description	Range	Default	Your Settings
	ACCESS = (1) PID To enter PID parameters, use ACCESS (1) & press ENTER.			
CH1				
PB1H	Enter the Channel 1 Proportional Band value, Heating.	0-900°F/0-500°C/0-500Units	45°F/25°C/25U	
RS1H	Enter the Channel 1 Reset value, Heating. Not displayed if PB1H = 0.	0.00 - 5.00 repeats/minute	0.00	
RT1H	Enter the Channel 1 Rate value, Heating. Not displayed if PB1H = 0.	0.00 - 5.00 minutes	0.00	
CT1H	Enter the Channel 1 Cycle Time value, Heating. Not displayed if PB1H = 0. Dependent on output & OUT1.	1 - 60 seconds	5	
RB1H	Enter the Channel 1 Rate Band value, Heating. Not displayed if PB1H = 0. 0 denotes rate is always functional.	0 - 7 times PB1H	0	
DB1	Enter the Current Dead Band value for Channel 1.	-36 to 36°F/-20 to 20°C -20 to 20 Units	0	
PB1C	Enter the Channel 1 Proportional Band value, Cooling.	0-900°F/0-500°C/0-500Units	45°F/25°C/25U	
RS1C	Enter the Channel 1 Reset value, Cooling. Not displayed if PB1C = 0.	0.00 - 5.00 repeats/minute	0.00	
RT1C	Enter the Channel 1 Rate value, Cooling. Not displayed if PB1C = 0.	0.00 - 5.00 minutes	0.00	
CT1C	Enter the Channel 1 Cycle Time value, Cooling. Not displayed if PB1C = 0. Dependent on output & OUT1.	1 - 60 seconds	5	
RB1C	Enter the Channel 1 Rate Band value, Cooling. Not displayed if PB1C = 0. 0 denotes rate is always functional.	0 - 7 times PB1C	0	
RETURN	Press the ENTER key to return to the SYSTEM prompt. Press the MODE key to return to the PID prompt.			

Table 9 continued

Prompt	Description ACCESS = (1) PID Continued To enter PID parameters, use ACCESS (1) & press ENTER.	Range	Default	Your Settings
CH2				
PB2H	Enter the Channel 2 Proportional Band value, Heating. Dependent on TYP parameter.	0-900°F/0-500°C/0-500Units	45°F/25°C/25U	
RS2H	Enter the Channel 2 Reset value, Heating. Not displayed if PB2H = 0. Dependent on TYP parameter.	0.00 - 5.00 repeats/minute	0.00	
RT2H	Enter the Channel 2 Rate value, Heating. Not displayed if PB2H = 0. Dependent on TYP parameter.	0.00 - 5.00 minutes	0.00	
CT2H	Enter the Channel 2 Cycle Time value, Heating. Not displayed if PB2H = 0. Dependent on output, TYP & OUT2.	1 - 60 seconds	5	
RB2H	Enter the Channel 2 Rate Band value, Heating. Not displayed if PB2H = 0. Dependent on TYP parameter. 0 denotes rate is always functional.	0 - 7 times PB2H	0	
DB2	Enter the Current Dead Band value for Channel 2. Dependent on TYP parameter.	-36 to 36°F/-20 to 20°C -20 to 20 Units	0	
PB2C	Enter the Channel 2 Proportional Band value, Cooling. Dependent on TYP parameter.	0-900°F/0-500°C/0-500U	45°F/25°C/25U	
RS2C	Enter the Channel 2 Reset value, Cooling. Not displayed if PB2C = 0. Dependent on TYP parameter.	0.00 - 5.00 repeats/minute	0.00	
RT2C	Enter the Channel 2 Rate value, Cooling. Not displayed if PB2C = 0. Dependent on TYP parameter.	0.00 - 5.00 minutes	0.00	
CT2C	Enter the Channel 2 Cycle Time value, Cooling. Not displayed if PB2C = 0. Dependent on output, TYP & OUT2.	1 - 60 seconds	5	
RB2C	Enter the Channel 2 Rate Band value, Cooling. Not displayed if PB2C = 0. Dependent on TYP parameter. 0 denotes rate is always functional.	0 - 7 times PB2C	0	
RETURN	Press the ENTER key to return to the SYSTEM prompt. Press the MODE key to return to the PID prompt.			

Prompt	Description ACCESS = (3) DIAGNOS To enter DIAGNOS parameter, use ACCESS (3) and press ENTER.	Range	Default	Your Settings
MAN1	Enter % power output for Channel 1.	-100 to 100%	--	
MAN2	Enter % power output for Channel 2. Dependent on TYP parameter.	-100 to 100%	--	
C2/RH	Displays Channel 2 ACTUAL temperature/humidity.	R2L to R2H	--	
RETURN	Press the ENTER key to return to the SYSTEM prompt. Press the MODE key to return to the DIAGNOS prompt.			

NOTE:

**Positive % always refers to the heat output, and
Negative % refers to the cool output.**

SETUP Menu

NOTE: Changing these parameter values will default other parameters and clear all files. See Page 53 & 54 for details.

Table 9 continued Make photocopies, keep original clean.

Prompt	Description	Range	Default	Your Settings
ACCESS = (5) SPCLFUNC To enter SPCLFUNC parameter, use ACCESS (5) and press ENTER.				
C/F/U	Enter the unit of measure code. (Celcius/Fahrenheit/Units) Not displayed if DIP Switch #2 is ON.	C/F/U	F	
TYP	Enter actual process display to be shown. Temperature/Process/Humidity Dual T/C Dual RTD Dual RTD 0.1 0.1 RTD, Process T/C, Process RTD, Process Dual Process Not displayed if DIP Switch #2 is ON.	T T or T T T or T H or T T T or T H or T T P or T V or T T P or T V or T T P or T V or T P P or P V or P	T T T T T T T P T P T P P P	
OUT1	Enter the control output for Channel 1, Outputs 1 and 2. Heat PID/Cool PID Cool PID/Heat PID Not displayed if DIP Switch #2 is ON.	HTCL CLHT	HTCL	
OUT2	Enter the control output for Channel 2, Outputs 3 and 4. Heat PID/Cool PID Cool PID/Heat PID Not displayed if DIP Switch #2 is ON. Dependent on TYP.	HTCL CLHT	HTCL	
R1L	Enter the Range Low value for Channel 1. Not displayed is DIP Switch #2 is ON.	Dependent on input selection. See your TYP parameter setting.		
R1H	Enter the Range High value for Channel 1. Not displayed if DIP Switch #2 is ON.	Dependent on input selection. See your TYP parameter setting.		
R2L	Enter the Range Low value for Channel 2. Not displayed if DIP Switch #2 is ON. Dependent on TYP.	Dependent on input selection. See your TYP parameter setting.		
R2H	Enter the Range High value for Channel 2. Not displayed if DIP Switch #2 is ON. Dependent on TYP.	Dependent on input selection. See your TYP parameter setting.		
AUX1	Enter the Auxiliary Output 1. AUX1 AL AUX 1 EV Not displayed if DIP Switch #2 is ON. Dependent on event board.	Alarm output Event output	AL	
AUX2	Enter the Auxiliary Output 2. AUX2 AL AUX2 EV Not displayed if DIP Switch #2 is ON. Dependent on TYP & event board.	Alarm output Event output	AL	
ALTP1	Enter Alarm Type 1. ALTP1 P ALTP1 D Not displayed if DIP Switch #2 is ON. Dependent on AUX1 & event board.	Process alarm Deviation alarm	P	
ALTP2	Enter Alarm Type 2. ALTP2 P ALTP2 D Not displayed if DIP Switch #2 is ON. Dependent on AUX2, TYP & event board.	Process alarm Deviation alarm	P	
LAT	Enter the Alarm function type. Not displayed if DIP Switch #2 is ON.	LAT or NLAT	NLAT	
RTD	Enter input gain of RTD input channels for different curves. Not displayed if DIP Switch #2 is ON. Dependent on input.	JIS or DIN	JIS	
ALT	Set altitude in feet for humidity mode. Not displayed if DIP Switch #2 is ON. Dependent on input.	0, 2500, 5000	0	
GS	Enter the Guaranteed Soak.	0 - 50°C	0	
ANLG	Enter parameter the Analog retransmit signal represents.	C1, C2, SP1, SP2	C1	
SCALE	Enter millivolts to scale analog retransmit output.	1, 2, 5, 10	1	
COM	Select between XON/XOFF or ANSI X3.28 protocol. Dependent on communications capability.	XON or STX	STX	
BAUD	Select baud rate for serial communications to run at. Dependent on communications capability.	1200, 2400, 4800, 9600	1200	
COM ID	Enter the Communications protocol Identification. Dependent on communications capability and COM = STX.	0 - 9	0	
LOCK	Enter the Front panel Lock code.	0 - 2	0	
CLR FILE	Press ENTER to display FILE?. Enter a file number to clear.	1 - 10	1	
RETURN	Press the ENTER key to return to the SYSTEM prompt. Press the MODE key to return to the SPCLFUNC prompt.			

Shaded parameters may not appear on your control. They are dependent on your control configuration.

SETUP Menu

SETUP

One of three main level operating menus. From the SETUP menu, you can set up or change system-operating parameters such as real time, high/low range, alarm types, alarm points, PID settings and communications. You must select each ACCESS number to create the personality of your Series 922.

ACCESS (0)

ACCESS number (0) must be selected to enter the personality of your Series 922 into the CALIB parameters.

CALIB

In the Series 922, when ACCESS (0) is entered under the SETUP menu, the CALIB parameters appear. These parameters setup the Real Time and the calibration offset of the process variable.

TI 00 : 00

Represents the current Real Time hours and minutes of the Series 922's System. Midnight = 0 hours and 0 minutes. Read only parameter.

HOUR ()

Represents the SYSTEM 24 hour time-of-day clock for hours.

Range: 0 to 23 hours **Default:** 0

MIN ()

The SYSTEM 24 hour time-of-day clock setting for minutes.

Range: 0 to 59 minutes **Default:** 0

CAL1 ()

An offset of the process variable for Channel 1. This number is added to the value that the system derives. The final result is used for the control point.

Range: -50 to 50 units or °C (-5.0 to 5.0 for tenths), or -90 to 90°F (-9.0 to 9.0 for tenths). **Default:** 0

CAL2 ()

An offset of the process variable for Channel 2. This number is added to the value that the system derives. The final result is used for the control point. CAL2 will not appear if TYP, under the SPCLFUNC menu, is set up for "T" (Temperature for Channel 1 only) or for "P" (Process for Channel 1 only).

Range: -50 to 50 units or °C (-5.0 to 5.0 for tenths), or -90 to 90°F (-9.0 to 9.0 for tenths). **Default:** 0

A1H ()

When AUX1 = AL and an external event board is connected, the Series 922 will display this parameter representing the high process alarm or high deviation alarm for Output 1. ALTYP1 parameter selects a process or deviation alarm.

Process Range: R1L to R1H (R1L-10% to R1H +10%)

Process Default: R1H (R1H +10%)

Deviation Range: 0 to 999°F/0 to 555°C **Deviation Default:** 999/555

A1L ()

This parameter represents the low process alarm or low deviation alarm for Output 1 of the Series 922. Displayed only when AUX1 = AL and an external event board is connected. ALTYP1 parameter selects a process or deviation alarm.

Process Range: R1L to R1H (R1L -10% to R1H +10%)

Process Default: R1L (R1L -10%)

Deviation Range: -R1H (or -555°C / -55.5°C / -999 F/U / -99.9 F/U) to 0

Deviation Default: Low end value

A2H ()

Represents the high process alarm or high deviation alarm for Output 2 of the Series 922. Displayed only when AUX2 = AL and an external event board is connected. ALTYP2 parameter selects a process or deviation alarm. This parameter will not appear if TYP, under the SPCLFUNC menu, is set to "T" (Temperature for Channel 1 only) or "P" (Process for Channel 1 only).

Process Range: R2L to R2H (R2L -10% to R2H +10%)

Process Default: R2H (R2H +10%)

Deviation Range: 0 to 999°F/0 to 555°C **Deviation Default:** 999/555

SETUP Menu

A2L ()

The low process alarm or low deviation alarm for Output 2 of the Series 922. Displayed only when AUX2 = AL and an external event board is present. ALTYP2 parameter selects a process or deviation alarm. This parameter will not appear if TYP, under the SPCLFUNC menu, is set to "T" (Temperature for Channel 1 only) or "P" (Process for Channel 1 only).
Process Range: R2L to R2H (R2L -10% to R2H +10%)
Process Default: R2L (R2L -10%)
Deviation Range: -R2H (or -555°C / -55.5°C / -999°F/U / -99.9 F/U) to 0
Deviation Default: Low end value

RETURN

From RETURN, you can go back to the SYSTEM prompt by pressing the ENTER key, or return to ACCESS (0) menu by pressing the MODE key.

ACCESS (1)

In the SETUP menu, ACCESS (1) must be selected to enter the PID parameters.

PID

CH1

When ACCESS (1) is entered under the SETUP menu of the Series 922, the PID parameters will appear. These parameters consist of Proportional, Integral (auto reset), and Derivative (rate) actions. Choose between CH1 or CH2 (Channel 1, Channel 2). If "T" or "P" have been entered in the TYP parameter under the SPCLFUNC menu, Channel 2 will not appear.
Range: CH1 - CH2 **Default:** CH1

PB1H ()

A proportional temperature band expressed in degrees, within which a temperature controller proportioning function is active for Channel 1 heating. Expressed in degrees.
Range: 0 to 900°F / 0 to 500°C / 0 to 500 Units; 0.0 to 90.0°F / 0.0 to 50.0°C / 0.0 to 50.0 Units.
Default: 45°F / 25°C / 25 Units; 4.5°F / 2.5°C / 2.5 Units

RS1H ()

A reset (integral) heating control action for Channel 1 that automatically eliminates offset, or "droop," between set point and actual process temperature in a proportional control. Expressed by repeats per minute. This parameter will not appear if PB1H is set to 0.
Range: 0.00 to 5.00 repeats/minute
Default: 0.00

RT1H ()

The rate (derivative) heating function for Channel 1 of the Series 922. The rate is determined by how fast the error being corrected is increasing. Expressed in minutes. This parameter will not appear if PB1H is set to 0.
Range: 0.00 to 5.00 minutes
Default: 0.00

CT1H ()

The Channel 1 heating cycle time usually expressed in seconds for a controller to complete one ON/OFF cycle. Time between successive turn ons. This parameter will not appear if: Your Series 922 has a 4-20mA output and OUT1 under the SPCLFUNC menu is set to HTCL, or PB1H is set to 0.
Range: 1 to 60 seconds
Default: 5

RB1H ()

A thermal control band for Channel 1 heating, that defines where the rate (derivative) function begins. This band is in multiples of the heat proportional band. This parameter will not appear if PB1H is set to 0.
Range: 0 to 7 times the PB1H, (0 denotes rate is always functional.)
Default: 0

SETUP Menu

DB1 ()	<p>The area for Channel 1 where no heating or cooling takes place in a heat/cool proportional control.</p> <p>Range: -36 to 36°F / -20 to 20°C / -20 to 20 Units; -3.6°F / -2.0 to 2.0°C / -2.0 to 2.0 Units.</p> <p>Default: 0</p>
PB1C ()	<p>A temperature band expressed in degrees within which a temperature controller proportioning function is active for Channel 1 cooling.</p> <p>Range: 0 to 900°F / 0 to 500°C / 0 to 500 Units; 0.0 to 90.0°F / 0.0 to 50.0°C / 0.0 to 50.0 Units.</p> <p>Default: 45°F / 25°C / 25 Units; 4.5°F / 2.5°C / 2.5 Units</p>
RS1C ()	<p>Reset (integral) cooling control action for Channel 1 that automatically eliminates offset, or "droop", between set point and actual process temperature in a proportional control. Expressed in repeats per minute. This parameter will not appear if PB1C is set to 0.</p> <p>Range: 0.00 to 5.00 repeats/minute</p> <p>Default: 0.00</p>
RT1C ()	<p>The rate (derivative) cooling function for Channel 1 of the Series 922. The rate is determined by how fast the error being corrected is increasing. Expressed in minutes. This parameter will not appear if PB1C is set to 0.</p> <p>Range: 0.00 to 5.00 minutes</p> <p>Default: 0.00</p>
CT1C ()	<p>The cooling cycle time for Channel 1 expressed in seconds for a controller to complete one ON/OFF cycle. Time between successive turn ons. This parameter will not appear if: Your Series 922 has a 4-20mA output and OUT1 under the SPCLFUNC menu is set to CLHT, or PB1C is set to 0.</p> <p>Range: 1 to 60 seconds</p> <p>Default: 5</p>
RB1C ()	<p>A thermal control band for Channel 1 cooling that defines where the rate (derivative) function begins. This band is in multiples of the cool proportional band. This parameter will not appear if PB1C is set to 0.</p> <p>Range: 0 to 7 times the PB1C (0 denotes rate is always functional)</p> <p>Default: 0</p>
RETURN	<p>From RETURN, you can go back to the SYSTEM prompt by pressing the ENTER key, or return to PID by pressing the MODE key.</p>
PID	<p>Under the PID menu, Channel 2 can be selected. These parameters consist of Proportional, Integral (auto reset), and Derivative (rate) actions. If "T" (Temperature for Channel1 only) or "P" (Process for Channel 1 only) have been entered in the TYP parameter under the SPCLFUNC menu, Channel 2 will not appear.</p> <p>Range: CH1 - CH2 Default: CH1</p>
CH2 ()	
PB2H ()	<p>A proportional temperature band expressed in degrees, within which a temperature controller proportioning function is active for Channel 2 heating. Expressed in degrees. This parameter will not appear if "T" or "P" (Channel 1 only) have been selected in the TYP parameter under the SPCLFUNC menu.</p> <p>Range: 0 to 900°F / 0 to 500°C / 0 to 500 Units; 0.0 to 90.0°F / 0.0 to 50.0°C / 0.0 to 50.0 Units / 0 to 500%RH.</p> <p>Default: 45°F / 25°C / 25 Units; 4.5°F / 2.5°C / 2.5 Units / 25%RH.</p>

SETUP Menu

RS2H ()

A reset (integral) heating control action for Channel 2 that automatically eliminates offset, or "droop", between point and actual process temperature in a proportional control. Expressed by repeats per minute. This parameter will not appear if PB2H is set to 0, or if "T" or "P" have been selected in TYP under the SPCLFUNC parameter.

Range: 0.00 to 5.00 repeats/minute **Default:** 0.00

RT2H ()

The rate (derivative) heating function for Channel 2 of the Series 922. The rate is determined by how fast the error being corrected is increasing. Expressed in minutes. This parameter will not appear if PB2H is set to 0.

Range: 0.00 to 5.00 minutes **Default:** 0.00

CH2H ()

The Channel 2 heating cycle time usually expressed in seconds for a controller to complete one ON/OFF cycle. Time between successive turn ons. This parameter will not appear if: Your Series 922 has a 4-20mA output and OUT2 under the SPCLFUNC menu is set to HTCL, PB2H is set to 0, or you have selected "T" or "P" (Channel 1 only) in the TYP parameter under the SPCLFUNC menu.

Range: 1 to 60 seconds **Default:** 5

RB2H ()

A thermal control band for channel 1 heating, that defines where the rate (derivative) function begins. This band is in multiples of the heat proportional band. This parameter will not appear if PB2H is set to 0, or "T" or "P" (Channel 1 only) in the TYP parameter under the SPCLFUNC menu have been selected.

Range: 0 to 7 times the PB2H, (0 denotes rate is always functional)
Default: 0

DB2 ()

The area for Channel 2 where no heating or cooling takes place in a heat/cool proportional control. This parameter will not appear if "T" or "P" (Channel 1 only) have been selected in the TYP parameter under the SPCLFUNC menu.

Range: -36 to 36°F / -20 to 20°C / -20 to 20 Units; -3.6 to 3.6°F / -2.0 to 2.0°C / -2.0 to 2.0 Units / -20 to 20%RH.

Default: 0

PB2C ()

A temperature band expressed in degrees within which a temperature controller proportioning function is active for Channel 2 cooling. This parameter will not appear if "T" or "P" (Channel 1 only) have been selected in the TYP parameter under the SPCLFUNC menu.

Range: 0 to 900°F / 0 to 500°C / 0 to 500 Units; 0.0 to 90.0°F / 0.0 to 50.0°C / 0 to 50.0 Units / 0 to 500%RH.

Default: 45°F / 25°C / 25 Units; 4.5°F / 2.8°C / 2.5 Units / 25% RH.

RS2C ()

Reset (integral) cooling control action for Channel 2 that automatically eliminates offset, or "droop", between set point and actual process temperature in a proportional control. Expressed in repeats per minute. This parameter will not appear if PB2C is set to 0, or "T" or "P" (Channel 1 only) in the TYP parameter under the SPCLFUNC menu have been selected.

Range: 0.00 to 5.00 repeats/minute **Default:** 0.00

RS2C ()

The rate (derivative) cooling function for Channel 2 of the Series 922. The rate is determined by how fast the error being corrected is increasing. Expressed in minutes. This parameter will not appear if PB2C is set to 0, or if "T" or "P" (Channel 1 only) in the TYP parameter under the SPCLFUNC menu have been selected.

Range: 0.00 to 5.00 minutes **Default:** 0.00

SETUP Menu

The cooling cycle time for Channel 2 expressed in seconds for a controller to complete one ON/OFF cycle. Time between successive turn ons. This parameter will not appear if: Your Series 922 has a 4-20ma output and OUT2 under the SPCLFUNC menu is set to CLHT, PB2C is set to 0, or "T" or "P" (Channel 1 only) in the TYP parameter under the SPCLFUNC menu has been selected.

Range: 1 to 60 seconds

Default: 5

CT2C ()

A thermal control band for Channel 2 cooling that defines where the rate (derivative) function begins. This band is in multiples of the cool proportional band. This parameter will not appear if PB2C is set to 0, or "T" or "P" (Channel 1 only) in the TYP parameter under the SPCLFUNC menu has been selected.

Range: 0 to 7 times the PB2C (0 denotes rate is always functional)

Default: 0

RB2C ()

From any RETURN, you can go back to the SYSTEM prompt by pressing the ENTER key, or return to PID by pressing the MODE key.

RETURN

In the SETUP menu, ACCESS (3) must be selected to enter the DIAGNOS parameters. Here you can manually adjust percent power for Channel 1 and 2.

ACCESS(3)

When ACCESS (3) is selected under the SETUP mode of the Series 922, the DIAGNOS parameters appear. The outputs will revert to (open loop) manual percent power control at the percent of power that they happen to be at before entering the DIAGNOS menu. The control will revert back to a closed loop control when you leave the DIAGNOS menu.

DIAGNOS

Allows the operator to manually adjust the percent power output for Channel 1. If set to 100, the heat output for Channel 1 is full ON.

Range: -100 to 100

Default: % power unit was at when DIAGNOS was entered.

MAN1 ()

Allows the operator to manually adjust the percent power output for Channel 2. This parameter will not appear if the TYP prompt has been set to "T" (Temperature for Channel 1 only) or "P" (Process for Channel 1 only). If set to 100, the heat output for Channel 2 is full ON.

Range: -100 to 100

Default: % power unit was at when DIAGNOS was entered.

MAN2 ()

Channel 2 ACTUAL temperature/humidity.

Range: R2L to R2H **Default:** Unprogrammed

C2/RH ()

From RETURN, you can go back to the SYSTEM prompt by pressing the ENTER key, or return to ACCESS (3) menu by pressing the MODE key.

RETURN

In the SETUP menu, ACCESS (5) must be selected to enter the SPCLFUNC parameters.

ACCESS(5)

When ACCESS (5) is selected under the SETUP mode of the Series 922, the Special Function (SPCLFUNC) parameters appear. Here you can select the degrees, output type, auxiliary, and alarm types among others.

SPCLFUNC

Accepts the sensor input and scales it to degrees Celsius, Fahrenheit, or Units of measure depending on the input type selected and the C/F/U selection made. This prompt will not appear if DIP switch #2 is ON. **Changing this parameter defaults parameters SP1, A1L, A1H, and clears all files.**

Range: C, F, or U

Default: F

C/F/U ()

SETUP Menu

TYP ()

Allows the operator to configure the unit to the type of actual process display to be shown. This also affects the number of channels. This parameter will not appear if DIP Switch #2 is ON. **Changing this parameter defaults all parameters and clears all files.**

Range: Dependent on input board type as follows:

T = Temperature H = Humidity P = Process

V = Vaisala RH sensor (HMM 30C)

Dual T/C	T T,	T	
Dual RTD	T T,	T H,	T
Dual RTD 0.1	T T,	T H,	T
0.1 RTD, Process	T P	T V	T
T/C, Process	T P,	T V	T
RTD, Process	T P,	T V	T
Dual Process	P P,	P V	P

Default: The first column entry of the above board types.

OUT1 ()

Select an output type for Channel 1. Action in response to the difference between set point and process variable. This parameter will not appear if DIP Switch #2 is ON.

Range:

<u>Alpha Display</u>	<u>Output 1</u>	<u>Output 2</u>
OUT1HTCL	Heat PID	Cool PID
OUT1CLHT	Cool PID	Heat PID

Default: HTCL

OUT2 ()

Select an output type for Channel 2. Action in response to the difference between set point and process variable. This parameter will not appear if the TYP parameter has been set to "T" (Temperature for Channel 1 only) or "P" (Process for Channel 1 only) under the TYP parameter, or DIP Switch #2 is ON.

Range:

<u>Alpha Display</u>	<u>Output 3</u>	<u>Output 4</u>
OUT2HTCL	Heat PID	Cool PID
OUT2CLHT	Cool PID	Heat PID

Default: HTCL

R1L ()

Represents a low limit to set point for Channel 1. The default values are also the low limits of your input type. This prompt will not appear if DIP Switch #2 is ON. **Changing this parameter defaults parameters SP1, A1L, A1H, and clears all files.**

R1H ()

Represents a high limit to set point for Channel 1. The default values are also the high limits of your input type. This prompt will not appear if DIP Switch #2 is ON. **Changing this parameter defaults parameters SP1, A1L, A1H, and clears all files.**

R2L ()

Represents the low limit to set points associated with Channel 2. Default values are also the low limits of the specific input type. This parameter will not appear if the TYP parameter has been set to "T" or "P" (Channel 1 only), or DIP Switch #2 is ON. **Changing this parameter defaults parameters SP2, A2L, A2H, and clears all files.**

R2H ()

Represents the high limit to set points associated with Channel 2. The default values are also the high limits of the specific input type. This parameter will not appear if the TYP parameter has been set to "T" or "P" (Channel 1 only), or DIP Switch #2 is ON. **Changing this parameter defaults parameters SP2, A2L, A2H, and clears all files.**

SETUP Menu

This parameter determines whether Auxiliary Output 1 will be an alarm or event output for the Series 922. This parameter will not appear if the 2 event or 8 event output board is not connected, or DIP Switch #2 is ON.

Range:

Alpha Display

Auxiliary Output 1's Function

AUX1 AL

Alarm Output defined for Event 1

AUX1 EV

Event Output defined for Event 1

Default: AL

AUX1 ()

This parameter determines whether Auxiliary Output 2 will be an alarm or event output for the Series 922. This parameter will not appear if: the external 2 event or 8 event output board is not connected; the TYP parameter has been set to "T" or "P" (Channel 1 only), or DIP Switch #2 is ON.

Range:

Alpha Display

Auxiliary Output 2's Function

AUX2 AL

Alarm Output defined for Event 2

AUX2 EV

Event Output defined for Event 2

Default: AL

AUX2 ()

Determines whether the alarm type for Auxiliary Output 1 will be a process alarm or a deviation alarm for the Series 922. This parameter will not appear if: The 2 or 8 event output board is not connected; AUX1 = EV; or DIP Switch #2 is ON.

Range:

Alpha Display

Alarm Type

ALTYP1 P

Process Alarm

ALTYP1 D

Deviation Alarm

Default: P

ALTYP1 ()

Determines whether the alarm type for Auxiliary Output 2 will be a process alarm or deviation alarm. This parameter will not appear if: The external 2 event or 8 event output board is not connected; if the TYP parameter has been set to "T" or "P" (Channel 1 only), or if DIP Switch #2 is ON.

Range:

Alpha Display

Alarm Type

ALTYP2 P

Process Alarm

ALTYP2 D

Deviation Alarm

Default: P

ALTYP2 ()

Selects alarms as latching or non-latching. Latching means the alarms remain active until you manually clear it. This will not appear if DIP Switch #2 is ON.

Range: LAT or NLAT

Default: NLAT

LAT ()

Allows the operator to change the input gain of one or both of the RTD input channels for different curves. This parameter will not appear if: The input board type is Dual T/C, T/C Process, or Dual Process, or DIP Switch #2 is ON.

Range: JIS or DIN

Default: JIS

RTD ()

The Altitude parameter represents the setting for altitude in feet above sea level for barometric correction when in the humidity mode. This parameter only appears if the TYP parameter is set to T/H. This parameter will not appear if DIP Switch #2 is ON.

Range: 0, 2500, 5000

Default: 0

ALT ()

The Guaranteed Soak parameter guarantees the actual temperature for Channel 1 is being controlled within a window around set point while a profile is running. If exceeded, the step time clock stops until the actual temperature is within the soak window. 0 = Guaranteed Soak is not active; >0 = Guaranteed Soak Window (active). Only applies to Channel 1.

Range: 0 to 90°F / 0 to 50 °C / 0 to 50 Units; 0 to 9.0°F / 0 to 5.0°C / 0 to 5.0 Units

Default: 0

GS ()

SETUP Menu

ANLG ()

Allows the operator to select which parameter the analog retransmit signal represents. For a chart recorder output, select C1 or C2. For a remote set point signal (to slave controls) select SP1 or SP2. C2 and SP2 will not appear if the TYP parameter is T or P. See SCALE parameter below for further explanation. C1 = Channel 1 actual, C2 = Channel 2 actual, SP1 = Set point channel 1, SP2 = Set point channel 2
Range: C1, C2, SP1, SP2 **Default:** C1

SCALE ()

Allows the operator to scale the analog retransmit output for a certain number of millivolts per least significant digit of the value. Reference 0 units = 0 volts.
Range: 1, 2, 5, 10mV **Default:** 1

COM ()

Represents the selection of the protocol type for serial communications. This selects XON/XOFF protocol or ANSI X3.28 communication protocol. This parameter will not appear if your Series 922 does not have communications.
Range: XON or STX **Default:** STX

BAUD ()

Represents the baud rate that serial communications will be running at. This parameter will not appear if your Series 922 does not have communications.
Range: 1200, 2400, 4800, 9600 **Default:** 1200

COM ID ()

Represents the device identification number as required for the ANSI X3.28 communications protocol for the Series 922. This parameter will not appear if COM has been selected as XON, or if your Series 922 does not have communications.
Range: 0 to 9 **Default:** 0

LOCK ()

Allows for specific groups of parameters to be unaffected by the UP/DOWN and ENTER keys, preventing these parameters from being changed accidentally.
0 = No lock, full access of all parameters.
1 = Prevents user from editing all parameters except the SYSTEM parameter group, the LOCK parameter, and the STEP and FILE parameter in the PROGRAM and pre-run menus.
2 = Prevents user from editing all parameters except ER1, ER2, ALRM in the SYSTEM menu, the LOCK parameter, and the STEP and FILE parameter in the PROGRAM and pre-run menus.
Range: 0 to 2 **Default:** 0

CLR FILE

Allows the operator to clear a file of the Series 922. Press ENTER, and choose the FILE? that you want to clear.
Range: 1 to 10




RETURN

From RETURN, you can go back to the SYSTEM prompt by pressing the ENTER key, or return to SPCLFUNC by pressing the MODE key.

PROGRAM Menu

From the Program menu, you can create your files. There can be up to ten profiles, consisting of a total of 99 steps. You can only choose one step type per step.

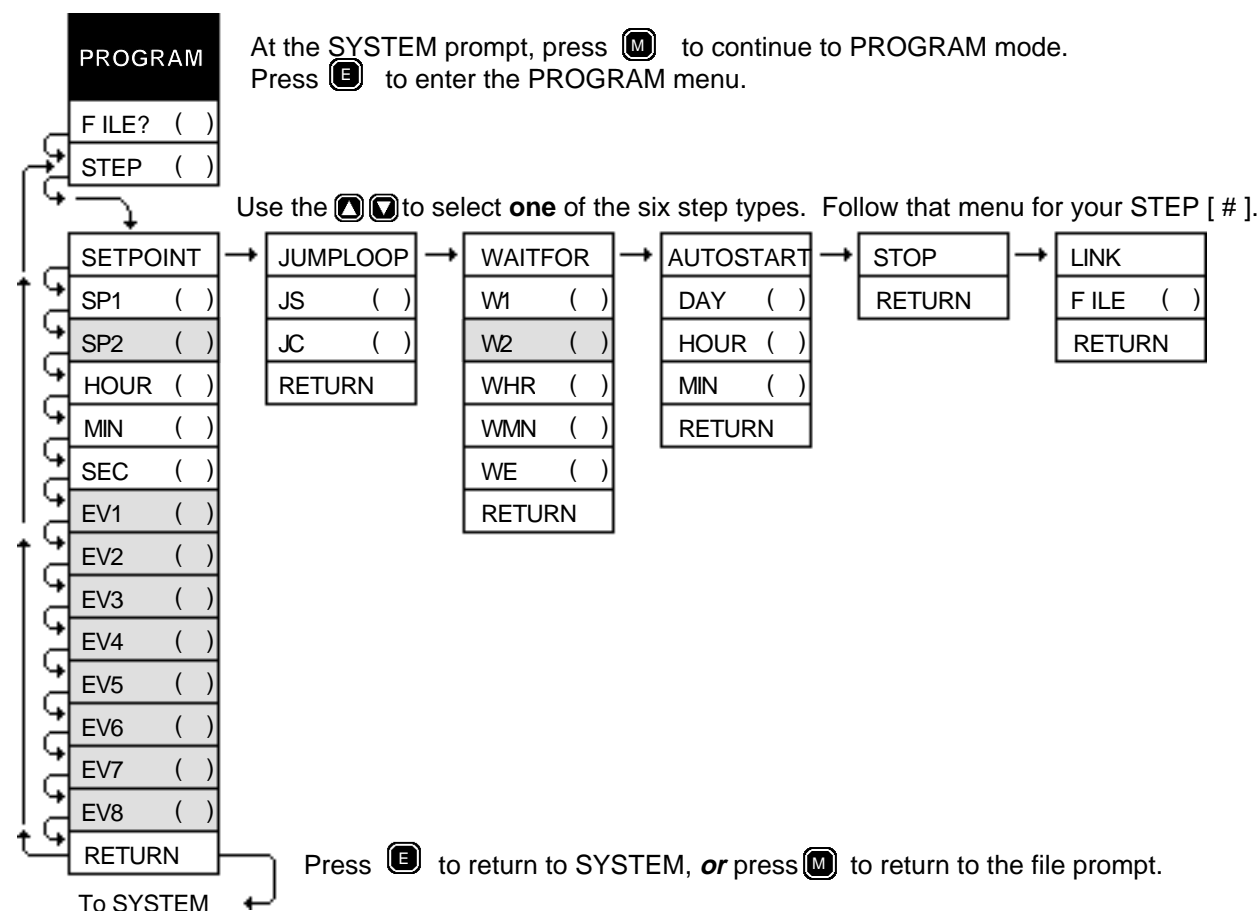
Graphics Key

-  = MODE Key
-  = ENTER Key
-  = UP/DOWN Key

NOTE: Shaded parameters may not appear on your control. These parameters are dependent on how your control is configured. See Pages 58 - 61 for more information.

NOTE: The Series 922 leaves the factory programmed for a warm start. STOP steps will appear as a default until you program your 922.

Figure 33 -
PROGRAM Key Flow



PROGRAM				
Prompt	Description	Range	Default	Your Settings
FILE?	Current system file to edit.	1 - 10	1	
STEP	Select step number to view or edit. Press MODE for step-type prompt. To change step-type use the increment/decrement key and press ENTER.	1-99	1	
SETPOINT - Step-Type				
SP1	Enter the temperature to achieve for the step's ending set point for Channel 1 according to the HOUR, MIN, SEC parameters.	R1L and R1H	-	
SP2	Enter the temperature to achieve for the step's ending set point for Channel 2 according to the HOUR, MIN, SEC parameters. Dependent on TYP parameter under SPCLFUNC.	R2L and R2H	-	
HOUR	Enter the hours programmed for this step.	0 - 23 hours	-	
MIN	Enter the minutes programmed for this step.	0 - 59 minute	-	
SEC	Enter the seconds programmed for this step.	0 - 59 seconds	-	
EV1	Enter the Event Output 1 status. Dependent on output & AUX1.	OFF or ON	-	
EV2	Enter the Event Output 2 status. Dependent on output & AUX2.	OFF or ON	-	
EV3	Enter the Event Output 3 status. Dependent on output board.	OFF or ON	-	
EV4	Enter the Event Output 4 status. Dependent on output board.	OFF or ON	-	
EV5	Enter the Event Output 5 status. Dependent on output board.	OFF or ON	-	
EV6	Enter the Event Output 6 status. Dependent on output board.	OFF or ON	-	
EV7	Enter the Event Output 7 status. Dependent on output board.	OFF or ON	-	
EV8	Enter the Event Output 8 status. Dependent on output board.	OFF or ON	-	
RETURN	Press the ENTER key to return to the SYSTEM prompt. Press the MODE key to return to the FILE? prompt.			
JUMLOOP - Step-Type				
JS	Enter the step number the 922 will jump to.	1 - 99	1	
JC	Enter the number of times the 922 will jump to the step indicated by JS.	0 - 100	0	
RETURN	Press the ENTER key to return to the SYSTEM prompt. Press the MODE key to return to the FILE? prompt.			
WAITFOR - Step-Type				
WHR	Enter the hours the 922 will wait relative to the beginning of the step.	0 - 23 hours	-	
WMN	Enter the minutes the 922 will wait relative to the beginning of the step.	0 - 59 minutes	-	
WE	Enter the state of the event input to wait for before continuing the program.	OPEN or CLSE	-	
W1	Enter a value to compare with the process variable of Channel 1.	R1L - R1H	-	
W2	Enter a value to compare with the process variable of Channel 2. Dependent on TYP parameter under SPCLFUNC.	R2L - R2H	-	
RETURN	Press the ENTER key to return to the SYSTEM prompt. Press the MODE key to return to the FILE? prompt.			
AUTOSTART - Step-Type				
DAY	Enter the number of days for the 922 to wait until AUTOSTART takes place.	0 - 6 days	-	
HOUR	Enter the number of hours for the 922 to wait for the time-of-day clock before AUTOSTART takes place.	0 - 23 hours	-	
MIN	Enter the number of minutes for the 922 to wait for the time-of-day clock before AUTOSTART takes place.	0 - 59 minutes	-	
RETURN	Press the ENTER key to return to the SYSTEM prompt. Press the MODE key to return to the FILE? prompt.			
STOP - Step-Type				
STOP	Press ENTER to display the last step of the program.			
RETURN	Press the ENTER key to return to the SYSTEM prompt. Press the MODE key to return to the FILE? prompt.			
LINK - Step-Type				
FILE?	The current system file will always link to Step 1 in the file specified.	1 - 10	1	
RETURN	Press the ENTER key to return to the SYSTEM prompt. Press the MODE key to return to the FILE? prompt.			

Shaded parameters may not appear on your control. They are dependent on your control configuration.

Program

One of three main level operating menus. From the SETUP menu, you can enter or view step type, program loops, wait for conditions, set points, auxiliary (event) outputs ON/OFF, and step duration.

FILE? ()

Represents the current SYSTEM file of the Series 922 to be edited or reviewed.

Range: 1 to 10 files **Default:** 1

STEP ()

Represents the current step of a file of the Series 922 to be edited or reviewed.

Range: 1 to 99 steps **Default:** 1

SETPOINT

One of six step types under the PROGRAM menu of the Series 922. Can be programmed as a file or a step to achieve or maintain a set point.

SP1 ()

Represents the temperature that the system will try to achieve on Channel 1 in the amount of time given. This will be done linearly, producing a ramp from a beginning set point to an end set point.

Range: R1L to R1H **Default:** Unprogrammed

SP2 ()

Represents the temperature that the system will try to achieve on Channel 2 in the amount of time given. This will be done linearly, producing a ramp from a beginning set point to an end set point. This parameter will not appear if the TYP prompt under the SPCLFUNC menu has been selected as "T" (Temperature for Channel 1 only) or "P" (Process for Channel 1 only).

Range: R2L to R2H **Default:** Unprogrammed

HOUR ()

The number of hours, in combination with the MIN and SEC parameters, that equal the total step time to achieve the temperature under the SETPOINT step-type.

Range: 0 to 23 hours **Default:** Unprogrammed

MIN ()

The number of minutes that equal total step time to achieve the temperature of the Series 922. Under the SETPOINT step-type.

Range: 0 to 59 minutes **Default:** Unprogrammed

SEC ()

The number of seconds that equal total step time to achieve the temperature of the Series 922 under the SETPOINT step-type.

Range: 0 to 59 seconds **Default:** Unprogrammed

EV1 ()

This auxiliary output can be an alarm or event. EV1 will only appear when AUX1 = EV, and the external event board is connected to the Series 922. Auxiliary outputs can be alarms or events.

Range: OFF or ON **Default:** Unprogrammed
OFF = Event OFF ON = Event ON

EV2 ()

EV2 can be an alarm or event. EV2 will only appear when AUX2 = EV, and the external event board is connected to the Series 922, or EV2 will appear if T or P in the TYP parameter under the SPCLFUNC menu have been selected and an external event board is present.

Range: OFF or ON **Default:** Unprogrammed
OFF = Event OFF ON = Event ON

Represents the state the 6 event outputs are forced to when the

PROGRAM Menu

EV3	()
EV4	()
EV5	()
EV6	()
EV7	()
EV8	()

SETPOINT step is executed. These events only appear when the 8 output event board is connected to the Series 922.

Range: OFF or ON **Default:** Unprogrammed
OFF = Event OFF ON = Event ON

RETURN

From RETURN, you can go back to the SYSTEM prompt by pressing the ENTER key, or return to FILE? by pressing the MODE key.

JUMLOOP

One of six step types under the PROGRAM menu of the Series 922 that can be programmed as a step or file. You can jump from one step to another within a file.

JS ()

The Series 922 will jump loop to any step within your current file. You cannot jump loop to another step in another file.

Range: 1 to 99 **Default:** 1

JC ()

The number of times that the Series 922 jumps to the step that was specified by the JS step. 0 = Infinite number of jumps.

Range: 0 to 100 **Default:** 0

RETURN

From RETURN, you can go back to the SYSTEM prompt by pressing the ENTER key, or return to FILE? by pressing the MODE key.

WAITFOR

One of six step types under the PROGRAM menu of the Series 922 that can be programmed to wait for a specific amount of time, a desired set point or both. When either or both are used, they must be true before the program continues.

W1 ()

Value the system compares against the process variable of Channel 1, and waits for, before proceeding to the next step of the program.

Range: R1L to R1H **Default:** Unprogrammed

W2 ()

Value the system compares against the process variable of Channel 2, and waits for, before proceeding to the next step of the program.

This parameter will not appear if "T" or "P" (Channel 1 only) in the TYP parameter under the SPCLFUNC menu have been selected.

Range: R2L to R2H **Default:** Unprogrammed

WHR ()

The hours the system will wait for, relative to when the step began. This is not a measure of time-of-day.

Range: 0 to 23 hours **Default:** Unprogrammed

WMN ()

Represents the minutes the system will wait for, relative to when the step began. This is not a measure of time-of-day.

Range: 0 to 59 minutes **Default:** Unprogrammed

WE ()

A wait for event input represented by a switch closure or opening, at which the 922 continues the program. This is not a voltage or current input.

Range: OPEN or CLSE **Default:** Unprogrammed

RETURN

From RETURN, you can go back to the SYSTEM prompt by pressing the ENTER key, or return to FILE? by pressing MODE.

AUTOSTART

One of six step types under the PROGRAM menu of the Series 922 that can be programmed to automatically start at a determined real time. The AUTOSTART function is dependent on the three parameter settings below ... DAY, HOUR and MIN. If there is a loss of power to the Series 922, the real time clock is also lost, and any programs dependent on time is incorrect.

DAY ()

Represents the number of days that the 922 waits until AUTOSTART takes place. Each time 00:00 is achieved, one day has gone by. If left blank (unprogrammed) the day count is ignored for use as a daily event rather than weekly.

Range: 0 to 6 days **Default:** Unprogrammed

HOUR ()

Stands for the hour that the 922 waits for the time-of-day clock before AUTOSTART takes place. Under the AUTOSTART step-type.

Range: 0 to 23 hours **Default:** Unprogrammed

MIN ()

This parameter represents the minutes that the 922 waits for on the time-of-day clock before AUTOSTART takes place. Under the AUTOSTART step-type.

Range: 0 to 59 minutes **Default:** Unprogrammed

RETURN

From RETURN, you can go back to the SYSTEM prompt by pressing the ENTER key, or return to FILE? by pressing MODE.

STOP

One of six step types under the PROGRAM menu of the Series 922, that indicates the end of any file.

RETURN

From RETURN, you can go back to the SYSTEM prompt by pressing the ENTER key, or return to FILE? by pressing MODE.

LINK

One of six step types under the PROGRAM menu of the Series 922 that allows you to link one file to another.

FILE ()

Enter the number of the file that you want to link to from here.

Range: 1 to 10 **Default:** 1

RETURN

From RETURN, you can go back to the SYSTEM prompt by pressing the ENTER key, or return to FILE? by pressing MODE.

Master Step Chart

Chart 1 - Master Step chart

Make photocopies, keep original clean.

Step #	<input checked="" type="checkbox"/> Step Type	Values			Time	Events ON or OFF							
						EV1	EV2	EV3	EV4	EV5	EV6	EV7	EV8
	<input type="checkbox"/> SETPOINT	SP1	SP2		HR:MN:SEC								
	<input type="checkbox"/> JUMPLoop	JS	JC										
	<input type="checkbox"/> WAITFOR	WE	W1	W2	WHR:WMN								
	<input type="checkbox"/> AUTOSTART				DAY:HR:MN								
	<input type="checkbox"/> STOP												
	<input type="checkbox"/> LINK	To FILE?											

Step #	<input checked="" type="checkbox"/> Step Type	Values			Time	Events ON or OFF							
						EV1	EV2	EV3	EV4	EV5	EV6	EV7	EV8
	<input type="checkbox"/> SETPOINT	SP1	SP2		HR:MN:SEC								
	<input type="checkbox"/> JUMPLoop	JS	JC										
	<input type="checkbox"/> WAITFOR	WE	W1	W2	WHR:WMN								
	<input type="checkbox"/> AUTOSTART				DAY:HR:MN								
	<input type="checkbox"/> STOP												
	<input type="checkbox"/> LINK	To FILE?											

Step #	<input checked="" type="checkbox"/> Step Type	Values			Time	Events ON or OFF							
						EV1	EV2	EV3	EV4	EV5	EV6	EV7	EV8
	<input type="checkbox"/> SETPOINT	SP1	SP2		HR:MN:SEC								
	<input type="checkbox"/> JUMPLoop	JS	JC										
	<input type="checkbox"/> WAITFOR	WE	W1	W2	WHR:WMN								
	<input type="checkbox"/> AUTOSTART				DAY:HR:MN								
	<input type="checkbox"/> STOP												
	<input type="checkbox"/> LINK	To FILE?											

Step #	<input checked="" type="checkbox"/> Step Type	Values			Time	Events ON or OFF							
						EV1	EV2	EV3	EV4	EV5	EV6	EV7	EV8
	<input type="checkbox"/> SETPOINT	SP1	SP2		HR:MN:SEC								
	<input type="checkbox"/> JUMPLoop	JS	JC										
	<input type="checkbox"/> WAITFOR	WE	W1	W2	WHR:WMN								
	<input type="checkbox"/> AUTOSTART				DAY:HR:MN								
	<input type="checkbox"/> STOP												
	<input type="checkbox"/> LINK	To FILE?											

Step #	<input checked="" type="checkbox"/> Step Type	Values			Time	Events ON or OFF							
						EV1	EV2	EV3	EV4	EV5	EV6	EV7	EV8
	<input type="checkbox"/> SETPOINT	SP1	SP2		HR:MN:SEC								
	<input type="checkbox"/> JUMPLoop	JS	JC										
	<input type="checkbox"/> WAITFOR	WE	W1	W2	WHR:WMN								
	<input type="checkbox"/> AUTOSTART				DAY:HR:MN								
	<input type="checkbox"/> STOP												
	<input type="checkbox"/> LINK	To FILE?											

Step #	<input checked="" type="checkbox"/> Step Type	Values			Time	Events ON or OFF							
						EV1	EV2	EV3	EV4	EV5	EV6	EV7	EV8
	<input type="checkbox"/> SETPOINT	SP1	SP2		HR:MN:SEC								
	<input type="checkbox"/> JUMPLoop	JS	JC										
	<input type="checkbox"/> WAITFOR	WE	W1	W2	WHR:WMN								
	<input type="checkbox"/> AUTOSTART				DAY:HR:MN								
	<input type="checkbox"/> STOP												
	<input type="checkbox"/> LINK	To FILE?											

Step #	<input checked="" type="checkbox"/> Step Type	Values			Time	Events ON or OFF							
						EV1	EV2	EV3	EV4	EV5	EV6	EV7	EV8
	<input type="checkbox"/> SETPOINT	SP1	SP2		HR:MN:SEC								
	<input type="checkbox"/> JUMPLoop	JS	JC										
	<input type="checkbox"/> WAITFOR	WE	W1	W2	WHR:WMN								
	<input type="checkbox"/> AUTOSTART				DAY:HR:MN								
	<input type="checkbox"/> STOP												
	<input type="checkbox"/> LINK	To FILE?											

Chapter 7

How To Use the Series 922 Alarms

One of the most versatile features of the Watlow Series 922 is its capability for alarms. The alarms can be automatic signals for process error or temperature related event-type actions in your system.

To use the alarms to their fullest extent, you need to understand what they are and what they will do. Here's an overview of the different alarm parameters again. Although you may already be aware of the alarms, notice how these parameters interact.

NOTE: If your unit does not have an external output board, or it's not connected, this section does not apply to your unit.

Alarm Relay Configuration

Series 922 alarm relays are configured to de-energize when the ACTUAL value is beyond the alarm limits. Normally open contacts are thus closed when temperatures are "OK." That way alarm conditions exist if power is lost from the control.

Number Of Alarms

There are two alarms in the Series 922, ALARM 1 and ALARM 2. These parameters indicate an alarm condition, or a de-energized alarm relay with a flashing ALRM~~X~~ - ~~XX~~ in the alphanumeric display. By retaining the indication of a previous alarm condition, an operator absent from the control panel can be aware that an alarm occurred. We'll look more closely at that in a few minutes.

Alarm 1 will only respond to Channel 1 and Alarm 2 only responds to Channel 2.

Alarm Types

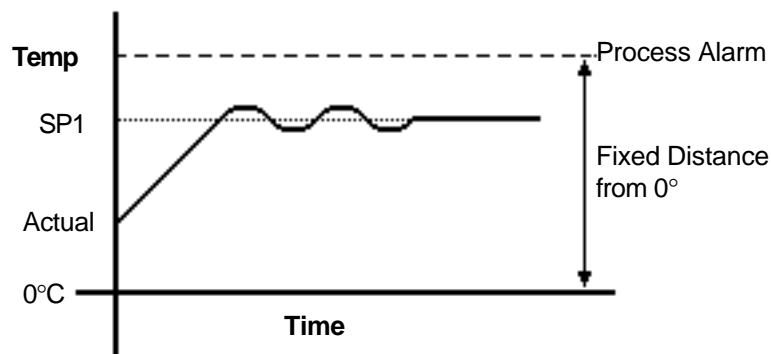
There are two Alarm Types for each alarm. ALTYP1 and ALTYP2 are the prompts for Alarm 1 and Alarm 2, respectively. The choices are: Process alarm (P), or Deviation alarm (D).

For review, a **"process"** type alarm is one that is set at a fixed degree distance, either positive or negative, from the mean 0°C or 0°F. A **"deviation"** type alarm is always a fixed degree distance, positive or negative, from Set Point (SP).

If we change SP, a process type alarm remains where it was originally set, while a deviation type alarm will shift with SP the same number of degrees as its value. The examples illustrate a plot of each alarm type.

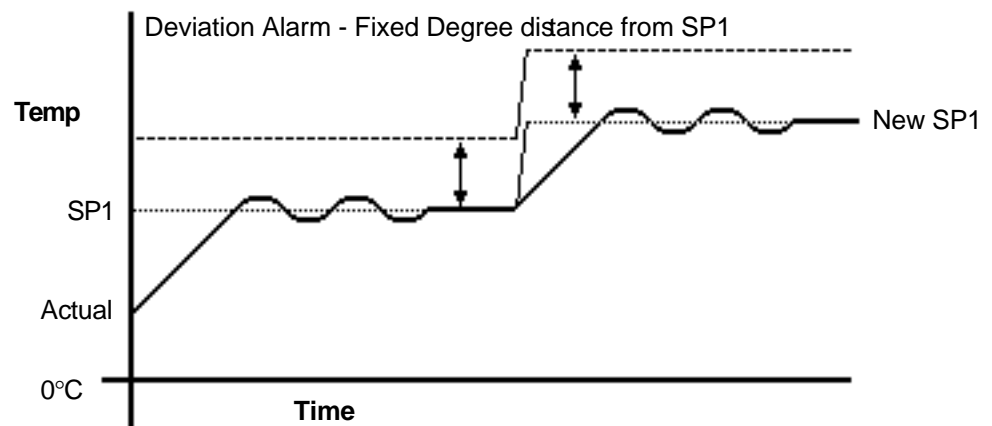
Here we've added a process alarm function to the basic graph.

**Figure 34 -
Alarm Type for
Alarm 1 is "Process"
Alarm (ALTYP1=P)**



This graph shows a deviation alarm setting, and how it shifts with a change in SP.

**Figure 35 -
Alarm Type for
Alarm 1 is a "Devia-
tion" Alarm (ALTYP
1=D)**



The Operating Band

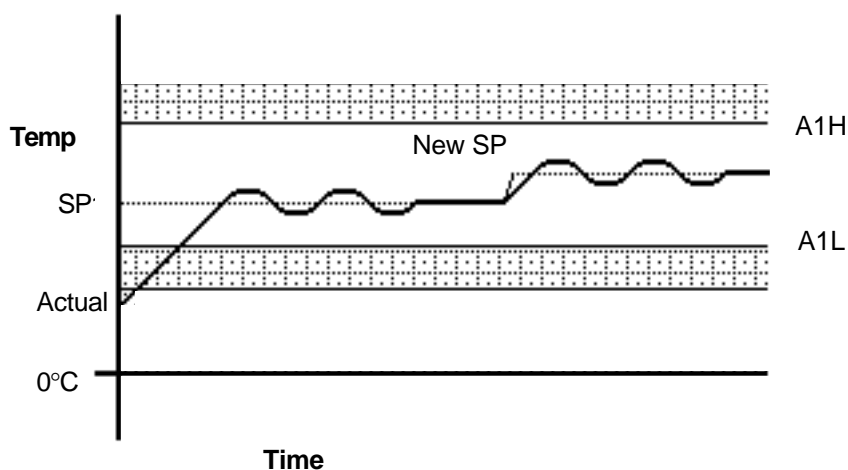
Now we need to set the alarm limits. In doing so, you'll define an "operating band" where you want system temperature (or your controlled variable) to be "OK" and alarm-free.

By selecting an alarm type (ALTYP), and then the alarm limits (A \underline{X} L, A \underline{X} H), you define the Operating Band. The extreme limits of the Operating Band are defined by the 922's high and low ranges, R \underline{X} L and R \underline{X} H.

Alarm Limits

You can set up alarm bands with the two available alarms. Each of the two alarms has a high and a low limit point, indicated by the "L" or "H" designation. You specify in the Operating Data where you want A1L, A1H, A2L, and A2H.

These limit points are themselves restricted by the controller's high and low range Operating Parameters, R \underline{X} H and R \underline{X} L. In other words, you can't set an alarm limit beyond the range limits you enter into the microprocessor.

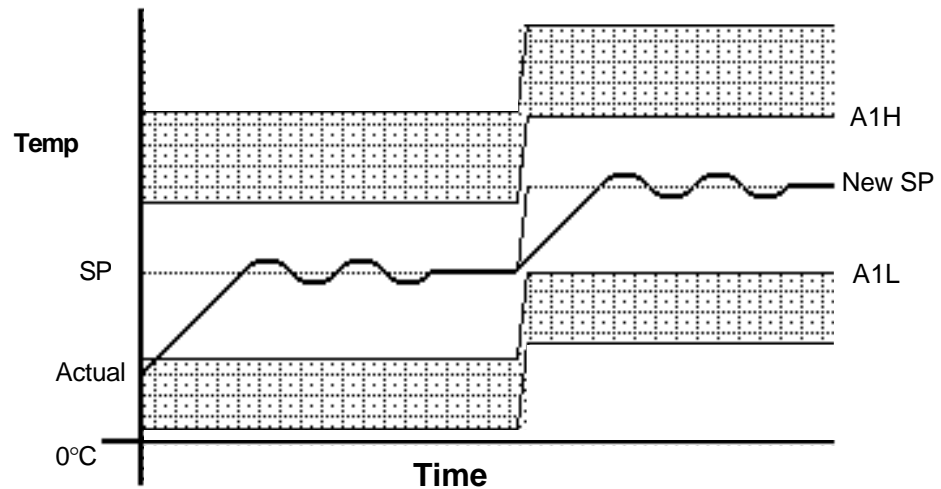


**Figure 36 -
Alarm Limits for
Alarms 1 and 2 with
"Process" Type
Alarm (ALTYP1=P,
ALTYP2=P)**

NOTE: Only Channel 1 is shown here.

Alarms

**Figure 37 -
Alarm Limits for
Alarms 1 and 2 with
"Deviation" Type
Alarm (ALTYP=D,
ALTYP=D)**



NOTE: Only Channel 1 is shown here.

Alarm Function, Latching or Non-Latching

Alarm function is either "latching" or "non-latching." Latching is a means of "saving" indication of an alarm event for the operator to clear manually. A latching alarm requires the operator to manually clear it with the ENTER key when ACTUAL returns to within the limits. A non-latching alarm clears itself automatically when ACTUAL returns to within the limits. It's your choice.

Here again is the "LAT" information from the Operating Parameters:

LAT Defines **Alarm Function:**

NLAT = Non-latching. Alarm relays are automatically energized when ACTUAL temperature returns to within the operating band (as defined by ALTYP X, AXL and AXH).

LAT = Latching. Requires the ENTER key to manually energize alarm relays after ACTUAL temperature returns to within the operating band (as defined by ALTYP X, AXL and AXH).

To clear an alarm in the RUN mode, simply press ENTER. To clear an alarm in the HOLD mode, return to the SYSTEM prompt. Press the MODE key until CLR ALRM is displayed and press ENTER.

Clearing An Alarm Message

You can clear a latched alarm when the ACTUAL display value returns to within the operating band. You do not need to clear, indeed, you cannot clear, a non-latching alarm. A non-latching alarm clears itself as soon as the ACTUAL display value returns to within the operating band. There is a 3°F switching differential.

An Alarm And The State Of The Alarm Relay

Simply stated, a flashing alarm on the 922 alphanumeric display indicates the state of the alarm relay contacts. A flashing alarm means that when an alarm condition is present (ACTUAL beyond an alarm limit), then the alarm relay is de-energized.

Appendix

Control Mode

- Microprocessor-based, user selectable modes.
- Dual inputs, dual control outputs per channel.
- 8 event outputs/1 event input/1 remote hold input.
- 99 step programmer with up to 10 profiles.
- Control outputs: User selectable as: Heat/Cool, Cool/Heat.
 - Outputs independent, or related via deadband for Heat/Cool.
 - ON/OFF: 3°F or 1.7°C switching hysteresis or 0.3°F or 0.17°C for 0.1° Units.
 - PID parameters per channel:
 - Proportional band: 0 to 500°C or 0 to 50.0°C for 0.1° Units.
 - Reset: 0.00 to 5.00 repeats per minute.
 - Rate: 0.00 to 5.00 minutes.
 - Rate band: 0 to 7 times proportional band.
 - Cycle time: 1 to 60 seconds.
 - Deadband: ±36°F, ±20° C or Units ± 2.0°C for 0.1° Units.
- Auxiliary outputs: User selectable as:
 - Events 1 & 2 selectable as alarms for Channels 1 & 2.
 - Process or deviation value, per output.
 - Alarms, latching or non-latching. When non-latching, control will have 3°F/1.7°C switching hysteresis or 0.3°F/0.17°C for 0.1° Units.
 - Separate high and low values, per output.

Operator Interface

- Membrane front panel.
- Four digit 1/2" LEDs displaying actual process input value.
- LED indication of °C, °F, or process variable units.
- MODE, ENTER, UP, DOWN, and RUN/HOLD keys.
- Eight character alphanumeric display of operating data.

Input

- Thermocouple, RTD and electrical process input.
- Automatic cold junction compensation for thermocouple.
- RTD input 2 or 3 wire, platinum, 100 ohm @ 0°C, calibrated to JIS curve #3916 (0.003916 Ω/Ω/°C), DIN curve #3850 (0.003850 Ω/Ω/°C).
- Sensor break protection de-energizes control outputs to protect system.
- Ungrounded sensors required..
- Operating ranges user selectable.

J t/c:	32	to	1382°F	or	0	to	750°C
K t/c:	-328	to	2282°F	or	-200	to	1250°C
T t/c:	-328	to	662°F	or	-200	to	350°C
1° RTD:	-328	to	1112°F	or	-200	to	600°C
0.1° RTD:	-99.9	to	392.0°F	or	-99.9	to	200.0°C
0-5VDC:	-99	to	1800 units				
4-20mA:	-99	to	1800 units				
RH, 0-5VDC:	0	to	100% RH				Vaisala sensor

- Calibration offset or input signal, ±90°F, ±50°C, ±50 PVU's, front panel adjustable 9.0°F, ±5.0°C for 0.1°C Units.
- °F, °C, or process variable units are user selectable.

Output - Control Per Channel (Single or Dual)

- Solid state relay, 0.5A @ 24VAC min. 264 VAC max., opto-isolated, zero cross switching.
- Solid state switch, 20mA @ 20VDC max, open collector switch-to-ground.
- 4-20mA into 600Ω load maximum.

Output/Input - Auxiliary

- External, plug-in module.
- Solid state relays, 2 or 8 ea., 0.5A @ 24VAC min. 264 VAC max.
- Auxiliary supply: 21 to 33VDC, 25mA maximum.
- Switched DC signal provides a minimum turn on voltage of 3VDC in a minimum 500Ω load. Maximum on voltage not greater than 32VDC into an infinite load.

Output - Analog Retransmit

- Device driven must have an input impedance $\geq 10k\Omega$.
- Reference: 0 Units = 0 Volts.
- Scalable: 1mV, 2mV, 5mV, or 10mV per LSD.
- Maximum voltage Span: -9.5 to +9.5 volts.

Accuracy

- Calibration Accuracy and Sensor Conformity: $\pm 0.15\%$ of span, ± 1 digit at $77^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ($25^{\circ}\text{C} \pm 3^{\circ}\text{C}$) ambient & rated line voltage $\pm 10\%$.
- Accuracy Span: 1000°F or 540°C minimum.
- Temperature Stability: $0.18^{\circ}\text{F}/^{\circ}\text{F}$ ($0.1^{\circ}\text{C}/^{\circ}\text{C}$) change in ambient.
- Voltage Stability: $\pm 0.01\%$ of span / % of rated line voltage.

Communications

- Serial data communications.
- RS-422A or RS-423A (RS-232C compatible).
- Most operator indication and controls.
- ANSI X3.28 protocol, or XON/XOFF protocol.
- Isolated.
- DB-9 Female connector.

Terminals

- #6 compression type screw terminals.

Power

- 115/230VAC $\pm 10\%$, 50/60Hz $\pm 5\%$.
- 18VA maximum.
- Data retention upon power failure via nonvolatile memory.

Operating Environment

- 32 to 130°F/0 to 55°C.
- 0 to 90% RH, non-condensing.

Dimensions

- | | | |
|--|---------|-------------|
| • Height: | 3.8 in. | (96.52 mm) |
| • Width: | 3.8 in. | (96.52 mm) |
| • Overall depth: | 7.0 in. | (177.80 mm) |
| • Behind panel depth: | 6.0 in. | (152.50 mm) |
| • with connector for communication and events: | 8.8 in. | (223.52 mm) |
| • Weight: | 2.8 lb | (1.27 kg) |

Ordering

922A-0-000

Series 922 =

Dual channel microprocessor-based, dual input, quad output, ramping controller, 99 steps, 1/4 DIN.

Input

- 1 = Dual RTD 1°
- 2 = RTD 1° and process
- 3 = Type T thermocouple and process
- 4 = Dual process
- 5 = Dual Type T thermocouple
- 6 = Dual RTD 0.1°
- 7 = RTD 0.1° and process
- 8 = Dual Type K thermocouple
- 9 = Dual Type J thermocouple
- A = Type K thermocouple and process
- B = Type J thermocouple and process

Output Per Channel

- BB = Dual solid state relay, Form A, 0.5A with RC contact suppression
- CC = Dual switched DC, non-isolated
- FB = Process, 4-20mA, non-isolated/solid state relay, Form A, 0.5A, with RC contact suppression

Communications

- A = None
- B = Isolated RS-423 (232C compatible)
- C = Isolated RS-422

A007-1732-

Auxiliary event board =

Remote event/alarm output board

Cable Length

- 18 = 18.0 in. (457 mm)
- Other lengths, contact factory.

Event Output

- C2 = (2) event outputs, switched DC, non-isolated
- C8 = (8) event outputs, switched DC, non-isolated
- B2 = (2) event outputs, solid state relay, Form A, 0.5A, with RC contact suppression
- B8 = (8) event outputs, solid state relay, Form A, 0.5A, with RC contact suppression
- K2 = (2) event outputs, solid state relay, Form A, 0.5A, without RC contact suppression
- K8 = (8) event outputs, solid state relay, Form A, 0.5A, without RC contact suppression

Thermocouple Field Calibration Procedure

Equipment Required

- Type "J", "K", or "T" (depending on model number) Reference Compensator with reference junction at 0°C/32°F **AND**
- Precision Millivolt Source.
- OR**
- Type "J", "K", or "T" thermocouple calibrator.
- 4-1/2 digit Digital Voltmeter (DVM). Can be used with either configuration above.

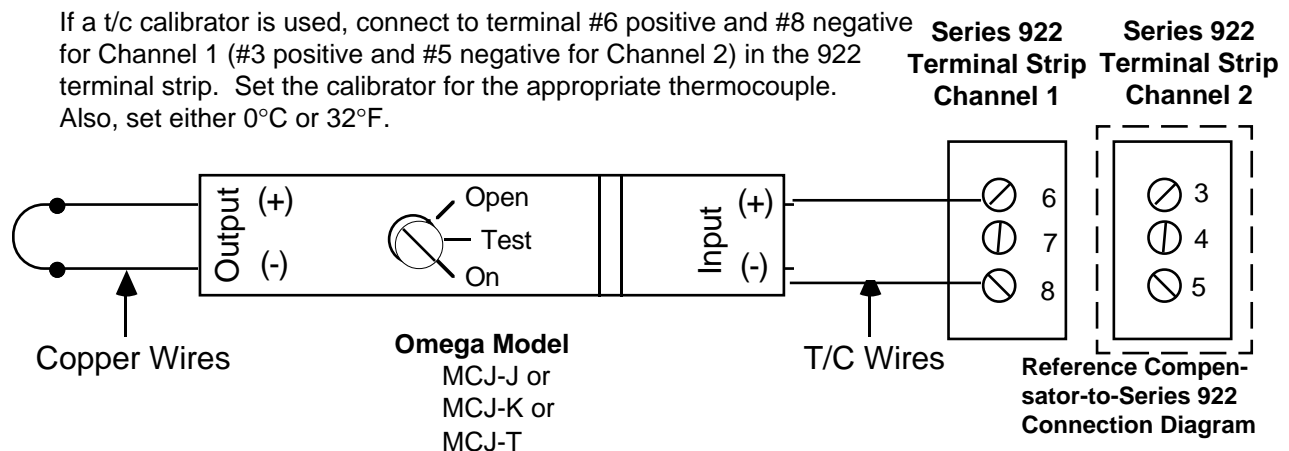
Setup and Calibration

NOTE:

Before calibration on an installed control, make sure all data and parameters are documented.

1. Connect the input side of the thermocouple reference compensator to #6 Positive and #8 Negative for Channel 1 [#3 Positive and #5 Negative for Channel 2] on the Series 922 terminal strip. Short the output side of the compensator and turn on the compensator. See Figure 38.

If a t/c calibrator is used, connect to terminal #6 positive and #8 negative for Channel 1 (#3 positive and #5 negative for Channel 2) in the 922 terminal strip. Set the calibrator for the appropriate thermocouple. Also, set either 0°C or 32°F.



2. Connect AC line voltage, L1 to #17, L2 to #20, ground to #21. Jumper for correct line voltage. See Chapter 4 "How to Install and Wire".
3. Set DIP Switch #6 to ON. Apply power to the unit and allow it to warm up for 15 minutes. The unit should be in the TEST mode.
4. Connect DVM common to TP2 and DVM positive to TP1 on the A007-1728 circuit board, located on the top side behind the center chassis support. DVM should be set up for DC volts, and in a range capable of displaying 6.3000 volts.

T/C Calibration

5. Press the MODE key until DAS6 XXXX appears on the alphanumeric display. Use the UP/DOWN keys to adjust the alphanumeric display to match the reading on the DVM. Once the two readings match, press the ENTER key.
6. Press the MODE key until CH1Z XXXX appears on the alphanumeric display for Channel 1 [CH2Z XXXX for Channel 2]. Enter 0.00 millivolts from the millivolt source to the reference compensator, or set the t/c calibrator to 0°C/32°F. Allow the Series 922 to stabilize for 10 seconds, press the ENTER key.
7. Press the MODE key until parameter CH1G XXXX for Channel 1 [CH2G XXXX for Channel 2] appears on the alphanumeric display. Using the table below, set the millivolt source to its appropriate setting, from the millivolt source to the reference compensator. If you are using the t/c calibrator, use the values in the table below. Allow the Series 922 to stabilize for 10 seconds, press ENTER.

Thermocouple Type	Millivolt Source Setting	T/C Calibrator Setting
J t/c	42.283mV	1382°F/750°C
K t/c	50.633 mV	2282°F/1250°C
T t/c	17.816mV	662°F/350°C

8. Remove power from the Series 922. Remove thermocouple wires from #6 and #8 for Channel 1 [#3 and #5 for Channel 2]. Turn off the compensator. Set DIP Switch #6 to the OFF position.

RTD Field Calibration Procedure

Equipment Required

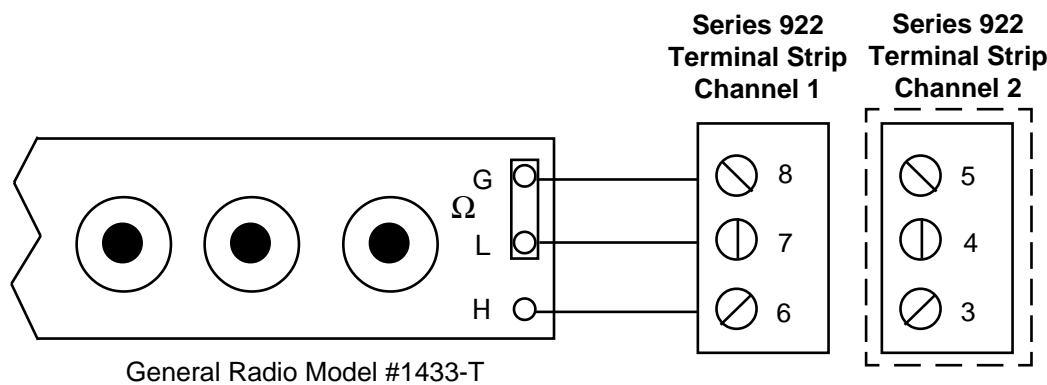
- 100 Ω precision decade resistance box with 0.01 ohms resolution.
- 4-1/2 digit, digital voltmeter (DVM).

Setup and Calibration

NOTE: Before calibration on an installed control, make sure all data and parameters are documented.

1. Connect the precision decade box to #6, #7, and #8 of the Series 922 terminal strip for Channel 1 as shown on Figure 39. For Channel 2 connect the precision decade box to #3, #4, and #5 of the terminal strip.
2. Connect AC line voltage, L1 to #17, L2 to #20, ground to #21. Jumper for

**Figure 39 -
Decade Resistance
Box-to-Series 922
Connection Diagram**



correct line voltage, see Chapter 4, "How to Install and Wire."

3. Set DIP Switch #6 ON. Apply power to the Series 922 and allow it to warm up for 15 minutes. The unit should be in the TEST mode.
4. Connect DVM common to TP2 and DVM positive to TP1 on the A007-1729 circuit board. Located on the top side behind the center chassis support. DVM should be set up for DC volts, and in a range capable of displaying 6.300 volts.
5. Using the MODE key, advance until the DAS6 XXXX parameter appears in the alphanumeric display. Using the UP/DOWN keys, adjust the alphanumeric display to match the DVM display. Press the ENTER key.
6. Press the MODE key until the CH1Z XXXX parameter, for Channel 1, appears on the alphanumeric display [CH2Z XXXX for Channel 2]. Set the

RTD Calibration

precision decade box to the correct RTD setting from Table 11 that corresponds to the type of 922 unit you have. Allow 10 seconds for settling, press the ENTER key.

7. Press the MODE key until CH1G XXXX for Channel 1 appears on the alphanumeric display [CH2G XXXX for Channel 2]. Set the precision decade box to the correct RTD setting from Table 11 that corresponds to the type of 922 unit you have. Allow 10 seconds for settling and then press the ENTER key. This unit is calibrated for JIS RTD on Channel 1 or 2.
8. Remove power from the Series 922. Remove wires from #6, #7, and #8 for Channel 1. Remove wires from #3, #4, and #5 for Channel 2. Set DIP Switch #6 to the OFF position.

**Table 11 -
RTD Parameter
Settings**

Parameters	1° RTD	0.1° RTD
CH1Z or CH2Z	100.00	119.73
CH1G or CH2G	317.33	177.13

Equipment Required

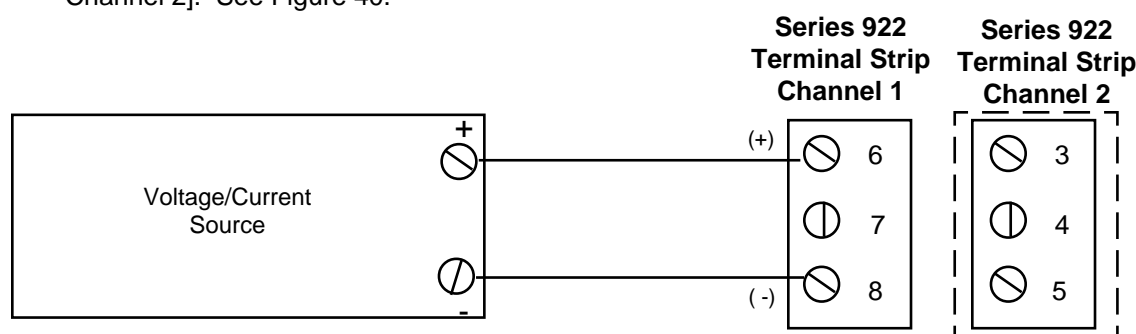
- 4-1/2 digit, digital voltmeter (DVM).
- Precision voltage/current source.

Setup and Calibration

NOTE: Before calibration on an installed control, make sure all data and parameters are documented.

1. Connect the voltage/current source to #6 Positive and #8 Negative on the Series 922 terminal strip for Channel 1 [#4 Positive and #5 Negative for Channel 2]. See Figure 40.

Figure 40 -
Voltage/Current
Source to Series 922
Connection Diagram



2. Connect AC line voltage, L1 to #17, L2 to #20, ground to #21 on the Series 922 terminal strip. Jumper for correct line voltage. See Chapter 4, "How to Install and Wire".
3. Set DIP Switch #6 ON. Apply power to the 922 and allow it to warm up for 15 minutes. The unit should be in the TEST mode.
4. Connect DVM common to TP2 and DVM positive to TP1 on the A007-1728 or A007-1729 circuit board, located on the top side behind the center chassis support. This circuit board is dependent on your model number. Your unit will have only one of these boards. DVM should be set up for DC volts, and in a range capable of displaying 6.3000 volts.
5. Press the MODE key until DAS6 XXXX appears on the alphanumeric display. Use the UP/DOWN keys to adjust the alphanumeric display on the 922 to match the reading on the DVM. Once the two readings match, press the ENTER key.
6. Press the MODE key until CH1Z XXXX appears on the alphanumeric display for Channel 1 [CH2Z XXXX for Channel 2]. ENTER 0mA, press ENTER. Allow 10 seconds for stabilizing, press the ENTER key.
7. Press the MODE key until CH1G XXXX appears on the alphanumeric display for Channel 1 [CH2G XXXX for Channel 2]. Input 20mA, press ENTER. The unit is now calibrated for Channel 1 process inputs. The process readings on the ACTUAL display should be at the R1H (or R2H) setting.
8. Remove power from the Series 922. Remove wires from #6 and #8 for Channel 1 [#3 and #5 for Channel 2]. Set DIP Switch #6 to the OFF position.

Glossary

This glossary includes general thermal system control terms.

ACCESS():	In the SETUP menu of the Series 922, an ACCESS number (0, 1, 3, 5) must be selected to enter the personality of your Series 922 into the CALIB, PID, DIAGNOS, and SPCLFUNC. Any other number will return to SYSTEM.
Actual Display data:	Displayed information which gives the operator/programmer real or "actual" data, i.e., actual process temperature. See "Programmed display data."
Alarm:	A condition, generated by the Series 922, indicating that the process has exceeded or fallen below the set or limit point.
ALTY1:	Present only when AUX1 = AL. Determines whether the alarm type for Auxiliary Output 1 will be a process alarm or a deviation alarm for the Series 922.
ALTY2:	Present only when AUX2 = AL. Determines whether the alarm type for Auxiliary Output 2 will be a process alarm or deviation alarm.
Analog retransmit:	Allows the operator to select which parameter the analog retransmit signal represents. For a chart recorder output, select C1 or C2. For a remote set point signal (to slave controls) select SP1 or SP2. C2 and SP2 will not appear if TYP parameter is T or P.
Anti-reset:	Control feature that inhibits automatic reset action outside of the proportional band.
Automatic Prompts:	Data entry points where a microprocessor-based control "prompts" or asks the operator/programmer for information input.
AUTOSTART:	One of six step types under the PROGRAM menu of the Series 922 that can be programmed to automatically start at a certain time, depending on the DAY, HOUR, and MIN parameter settings.
AUX1:	This parameter determines whether Auxiliary Output 1 will be an alarm or event output for the Series 922.
AUX2:	This parameter determines whether Auxiliary Output 2 will be an alarm or event output for the Series 922.
A1H:	When AUX1 = AL, it represents the high process alarm or high deviation alarm for Alarm 1.
A1L:	This parameter represents the low process alarm or low deviation alarm for Alarm 1 of the Series 922. Displayed only when AUX1 = AL.
A2H:	Represents the high process alarm or high deviation alarm for alarm 2 of the Series 922. Displayed only when AUX2 = AL.
A2L:	The low process alarm or low deviation alarm for Alarm 2 of the Series 922. Displayed only when AUX2 = AL.

BAUD:	Represents the baud rate (1200, 2400, 4800, 9600) that serial communications will be running at. This parameter will not appear under ACCESS (5) of the SPCLFUNC menu if your Series 922 does not have communications.
CAL1, CAL2:	An offset of the process variable for Channel 1 or Channel 2. This number is added to the value that the system derives. The final result is used for the set point as well as a front panel indication.
CALIB:	In the Series 922, when ACCESS (0) is entered under the SETUP menu, the CALIB parameters appear. These parameters setup the Real Time and the calibration offset of the process variable.
C/F/U:	Accepts the sensor input and scales it to degrees Celsius, Fahrenheit, or Units of measure.
Closed Loop:	Control system that has a sensing device for process variable feedback.
CLR FILE:	Allows the operator to clear a file of the Series 922.
Cold Start:	A "clean", or completely cleared-of-user-program-information, start-up condition. (Factory settings.)
COM:	Represents the selection of the protocol type for serial communications. This selects XON/XOFF protocol or ANSI X3.28 communication protocol under the ACCESS (5) SPCLFUNC menu. This parameter will not appear if your Series 922 does not have communications.
COM ID:	Represents the device identification number as required for the ANSI X3.28 communications protocol for the Series 922.
CT1C/CT2C:	The Cooling Cycle Time, for Channel 1 or Channel 2, usually expressed in seconds for a controller to complete one ON/OFF cycle. The time between successive turn ons.
CT1H/CT2H:	The Heating Cycle Time, for Channel 1 or Channel 2 usually expressed in seconds for a controller to complete one ON/OFF cycle. Time between successive turn ons.
Cycle time:	The time necessary to complete a full ON-through-OFF period in a time proportioning control system.
DAY:	Represents the number of days that the 922 will wait until AUTOSTART takes place. Each time 00:00 is achieved, one day has gone by.
DB1/DB2:	The Dead Band parameter for Channel 1 or Channel 2 representing the area where no heating or cooling takes place in a heat/cool proportional control.
Dead band:	A temperature band between heating and cooling functions.
Derivative:	Anticipatory action that senses the rate of change of temperature, and compensates to minimize overshoot and undershoot. Also "Rate".
Deviation:	The difference between the value of the controlled variable and the value at which it is being controlled.

Glossary, D - H

Default parameters:	The parameters, or programmed instructions, which are permanently stored in microprocessor software to provide a data base.
DIP Switch:	A Dual In-line Package switch.
DIN:	Deutsche Industrial Norms, a widely-recognized German standard for engineering units.
Display capability:	In a digital indicating instrument, the entire span that can be indicated if fully utilized.
Droop:	The difference in temperature between set point and stabilized process temperature.
Duty cycle:	Percentage of "load ON time" relative to total cycle time.
ER1:	ER1 (Error 1) is considered a fatal error; your system will shut down. When the Series 922 shuts down, all events will be turned off, and your program will stop running. When an error occurs, ER1 00XX will alternately flash with the SYSTEM mode, and ENTER the ER1 parameter. This will clear your error unless it is a re-occurring error and has not been resolved.
ER2:	ER2 (Error 2) is considered nonfatal. If you are in the RUN mode, your program will continue running unless it is a program error. ER2 00XX appears, and will flash alternately along with the parameter that you are presently on. Clear an ER2 parameter under the SYSTEM mode. If the error persists, refer to the Error Code list on Page 90 to clear.
Events:	An event is an ON/OFF auxiliary output relay signal. You can use events, based on time, temperature, or other process variables, to trigger peripheral equipment or process.
EV1 & EV2:	These auxiliary outputs can be alarms or events. EV1 and EV2 only appear when AUX1 and AUX2 = EV respectively, and when the two or eight output external event board is connected. You can change the state of the events only in the HOLD mode. Auxiliary outputs can be alarms or events.
EV3 - EV8:	These auxiliary outputs are events. EV3 through EV8 only appear when the eight output external event board is connected.
FILE:	Represents the current SYSTEM file of the Series 922 to be edited or reviewed. Under the LINK parameter, FILE? stands for the file that you want to link to.
GS:	The Guaranteed Soak parameter guarantees that the actual temperature of Channel 1 is being controlled within a window around set point. If exceeded, the step time clock will stop until the actual temperature is within the soak window.
HOUR:	<p>The HOUR parameter has three meanings, depending upon which menu you are in.</p> <p>PROGRAM menu - The number of hours, in combination with the MIN and SEC parameters, that equal the total step time to achieve the temperature.</p> <p>Under the AUTOSTART step type, the hours that the 922 will wait for the time-of-day clock before AUTOSTART takes place.</p> <p>SETUP menu - Represents the SYSTEM 24 hour time-of-day clock. Midnight = 0 hours.</p>

Hunting:	Oscillation or fluctuation of process temperature between set point and process variable.
Hysterisis:	In ON/OFF control, the temperature change necessary to change the output from full ON to full OFF.
Input:	Process variable information being supplied to the instrument.
Integral:	Control action that automatically eliminates offset, or "droop", between set point and actual process temperature. Also reset.
Isolation:	Electrical separation of sensor from high voltage circuitry. Allows for application of grounded or ungrounded sensing element.
JC:	The Jump Count parameter represents the number of times that the Series 922 will jump to a specified step.
JS:	The Jump Step parameter of the Series 922 will jump to any step within your current file. You cannot Jump Step to another step in another file.
JUMLOOP:	One of six step types under the PROGRAM menu of the Series 922, that can be programmed as a step or a file. You can jump from one step to another within a file.
LAT:	Latches your alarm outputs when the Series 922 has an alarm condition. Remains active until you manually clear any alarms.
LINK:	One of six step types under the PROGRAM menu of the Series 922, that allows you to link one file to another.
LOCK:	Allows for specific groups of parameters to be unaffected by the Up/DOWN and ENTER keys, preventing these parameters from being changed accidentally. 0 = No lock, full access of all parameters. 1 = Prevents user from editing all parameters except the SYSTEM parameter group, FILE and STEP. 2 = Prevents user from editing all parameters except ER1, ER2, ALRM in the SYSTEM menu, the LOCK parameter, the STEP and FILE parameter in the PROGRAM menu.
MIN:	<p>The MIN parameter has three meanings depending upon which parameter you are in.</p> <p>PROGRAM menu - The number of minutes that equal total step time to achieve the temperature of the Series 922.</p> <p>Under the AUTOSTART step type in the PROGRAM menu, it represents the minutes that the 922 will wait for on the time-of-day clock before AUTOSTART takes place.</p> <p>SETUP menu - The SYSTEM 24 hour time-of-day clock setting.</p>
Offset:	Adjustment to actual input temperature and to the temperature values the Series 922 uses for display and control.
ON/OFF control:	Control of temperature about a set point by turning the output full ON below set point and full OFF above set point in heat mode.
Open loop:	Control system with no sensory feedback. The 922 uses a closed loop.
Operating band:	Area around set point in the Series 922 where ACTUAL temperature is deemed safe, or "OK". The band is defined under ACCESS (5), SPCLFUNC, under the SETUP menu by Alarm Types (ALYP1 and ALYP2) and under ACCESS (0), CALIB, by Alarm High and Low Limits (A1H, A1L and A2H, A2L).

Glossary, O - R

OUT:	Select an output type. Action in response to the difference between set point and process variable.
Output:	Action in response to difference between set point and process variable.
Overshoot:	Condition whereby temperature exceeds set point due to initial power up or process changes.
PB1C/PB2C:	A proportional temperature band for Channel 1 or Channel 2 expressed in degrees within which a temperature controller proportioning function is active for cooling expressed in degrees.
PB1H/PB2H::	A proportional temperature band for Channel 1 or Channel 2 expressed in degrees within which a temperature controller proportioning function is active for heating. Expressed in degrees.
P control:	Proportioning control.
Parameter:	A physical property whose value determines the response of an electronic control to given inputs.
PD control:	Proportioning control with rate action.
PI control:	Proportioning control with auto-reset.
PID:	When ACCESS (1) is entered in the Series 922, the PID parameters will appear. These parameters consist of Proportional, Integral (auto reset), and Derivative (rate) actions.
PID control:	Proportioning control with auto-reset and rate.
Process Variable:	Thermal system element to be regulated, such as time temperature, relative humidity, etc.
Programmed display data:	Displayed information which gives the operator/programmer the "programmed" or intended process information, i.e., intended set point, intended alarm limit, etc. See "Actual displayed data."
Proportional band:	The span of temperature about the set point where time proportional control action takes place.
Proportioning control:	See Time proportioning control.
R1H/R2H:	Represents a high limit to set point for Channel 1 or Channel 2. The default values are also the high limits of your input type.
R1L/R2L:	Represents a low limit to set point for Channel 1 or Channel 2. The default values are also the low limits of your input type.
Rate:	Anticipatory action that senses the rate of change of temperature and compensates to minimize overshoot. Also "derivative."
Rate Band:	A thermal control band that defines where the rate (derivative) function begins. A Watlow rate band occurs centered on set point at one or more times the width of the proportional band.
RB1C/RB2C:	The thermal control band for cooling in Channel 1 or Channel 2 that defines where the rate (derivative) function begins.

RB1H/RB2H:	A thermal control band for heating in Channel 1 or Channel 2 that defines where the rate (derivative) function begins.
RS1C/RS2C:	Reset (integral) cooling control action for Channel 1 or Channel 2 that automatically eliminates offset, or "droop", between set point and actual process temperature in a proportional control. Expressed in repeats per minute.
RS1H/RS2H:	A reset (integral) heating control action for Channel 1 or Channel 2 that automatically eliminates offset, or "droop," between set point and actual process temperature in a proportional control. Expressed in minutes.
RT1C/RT2C:	The Rate (derivative) Cooling function for Channel 1 or Channel 2 that is determined by how fast the error being corrected is increasing. Expressed in minutes.
RT1H/RT2H:	The Rate (derivative) for the Heating function for Channel 1 and Channel 2 that is determined by how fast the error being corrected is increasing. Expressed in minutes.
Reference junction:	Synonymous with cold junction. See "Cold junction."
Reset:	Control action that automatically eliminates offset, or "droop," between set point and actual process temperature. Also "integral."
Reset windup inhibit:	Synonymous with anti-reset. See "Anti-reset."
RETURN:	From any RETURN parameter, you can go back to SYSTEM.
RTD:	Resistance Temperature Detector. Resistive sensing device displaying resistance versus temperature characteristics. Displays positive temperature coefficient.
SE1/SE2:	Only appear when in the RUN mode. Represents the set endpoint of the current step for Channel 1 or Channel 2 that the Series 922 will try to achieve in the amount of time given. This will be done linearly, producing a ramp from a beginning set point to an end set point. Seen only in the RUN mode.
SEC:	The number of seconds that equal total step time to achieve the temperature of the Series 922.
Set point:	Intended value of the process variable.
SETPPOINT:	One of six step types under the PROGRAM menu of the Series 922. Can be programmed as a file or a step to achieve or maintain a set point.
SP1/SP2:	When in the PROGRAM menu, this is the set point that the control will try to achieve by the end of the step. When in the RUN mode it represents the current set point. Its primary function is as the control point of the closed loop.
SPCLFUNC:	When ACCESS (5) is selected under the SETUP mode of the Series 922, the Special Function parameters appear. Here you can select the input type, degrees, output type, auxiliary and alarm types among others.
STEP:	Represents the current SYSTEM file step of the Series 922 to be edited or reviewed.
STOP:	One of six step types under the PROGRAM menu of the Series 922, that will indicate the end of any file.

Glossary, S - Z

SYSTEM:	One of three main level operating parameters. From the SYSTEM menu, you can generate a non-ramping set point (fixed), manipulate Events 1 through 8, clear error codes and latching alarms, and monitor Channel 2's actual temperature and the external input.
Switching sensitivity:	In ON/OFF controls, the temperature change necessary to change the output from full ON to full OFF (3° or °F in the Series 922.)
Thermal System:	A regulated environment consisting of a heat source, heat transfer medium, sensing device and a process variable control instrument.
Thermocouple:	Temperature sensing device that is constructed of two dissimilar metals wherein a measurable, predictable voltage is generated corresponding to temperature.
Thermocouple break protection:	Fail-safe operation that assures output shutdown upon an open thermocouple condition.
Three mode control:	Proportioning control with reset and rate.
TI:	Represents the Real Time hours and minutes of the Series 922's system.
Time proportioning control:	Action which varies the amount of ON and OFF time when "close" to the set point, i.e., in the proportional band. This variance is proportional to the difference between the set point and the actual process temperature. In other words, the amount of time the output relay is energized depends on the system temperature.
Triac:	Solid state switching device.
WAITFOR:	One of six step types under the PROGRAM menu of the Series 922 that can be programmed to wait for a specific amount of time, or a process value.
Warm start:	Start-up condition where all program information is remembered by the instrument's memory backup protection.
WE:	Represents the state that the Series 922 will wait for, in the program, for the remote event input to be present.
WHR:	The hour that the system will wait for relative to when the step began. This is not a measure of time-of-day.
WMN:	Represents the minutes that the system will wait for relative to when the step began. This is not a measure of time-of-day.
W1/W2:	Temperature that the system will compare against the process variable of Channel 1 or Channel 2, and wait for, before proceeding to the next step.
Zero switching:	Action which provides output switching only at the zero voltage crossing points of the AC line.

A

Accessories, 70
 Actual and Alphanumeric Display Area, 13, Fig. 6
 Alarms,
 Clearing, 67
 Function, 66
 Limits, 65
 Types, 64
 AUTOSTART Step Type, 18

B

Backward Jump, 40

C

Calibration, 71
 Chart Recorder, 36, 56
 Clean Input Power, The Do's and Don'ts, 23
 Combination Differential Filter, 25, Fig. 11
 Common Mode Filter Wiring, 25, Fig. 10

D

Decade Resistance Box-to-Series 922 Connection Diagram, 73, Fig. 41
 Default Parameters, 43, 46-48, 58
 Differential Mode Filter Wiring, 25, Fig. 9
 Dimensions,
 External Event/Alarm Board, 27, Fig. 14
 Faceplate, 26, Fig. 12
 Panel Cutout, 27, Fig. 15
 Sideview, 27, Fig. 13
 DIP Switch,
 Location, 10 Fig. 3
 Selection, 10, Table 1
 DIP Switches, 10, 38
 How to Set, 9

E

Editing Your Program, 17
 Enter Operating Data And Operating Parameters, Chapter 6, 42
 Error Codes, 87
 Event,
 Inputs, 28, 33, 38, 44
 Outputs, 34

F

Forward Jump, 40

G

Glossary, 76
 Ground Loops, 24
 Guaranteed Soak (GS), 39

H

How To,
 Install And Wire The Series 922, Chapter 4, 21
 Install the Series 922, 26
 Open the 922, 9, Fig. 2
 Program the 922, Chapter 6, 38

Set DIP Switches, 9
 Tune, Chapter 5, 36
 Run, 20
 Use Alarms, Chapter 7, 63
 Use the Keys and Displays, Chapter 2, 12
 Wire The Series 922, 29

I

Index, 83
 Input Options, 29, Fig. 17-21
 Input Power Definitions, 23
 Intertwined Loop, 41
 Installation Procedure, 26

J

JUMLOOP,
 Types, 40
 Rules to Follow, 41

K

Keyboard Area, 13 Fig. 7

L

Line Filtering Configuration, 24
 LINKing Files, 18

M

Master Step Chart, 62, Chart 1
 Microprocessor Are In a Way Like Trout..., 22
 Model Number, 70
 Modes, Overview, 11

N

Nested Loop, 41
 Noise,
 Suppression Device Ratings, 24, Table 7

O

Open the 922, How to, 9, Fig. 2
 Output "BB" Wiring, Dual SS Relay, 32, Fig. 22
 Output "CC" Wiring, SS Switch, 32, Fig. 23
 Output "FB" Wiring, 4-20mA/SS Relay, 32, Fig. 24
 Overview of the 922 Operating Modes, 11, Fig. 4

P

Packing List, 8
 Power Wiring, 28, Fig. 16
 Preventing Noise, Installation Guidelines, 23
 Process Calibration, 75
 Process Variable Unit, 4-20mA/SS Relay, 31, Fig. 24
 PROGRAM, 57

Q

Quick Reference, 89

Index

R

- Read Me First, 7
- Reference Compensator-to-Series 922 Connection Diagram, 71, Fig. 40
- Returns, 85
- RTD Parameter Settings, 74, Table 11
- RTD Sensor Wiring,
 - Dual, 29, Fig. 17
 - RTD/Process, 30, Fig. 18
- Running Your Series 922, 20, Fig. 8

S

- Sample Program, Chapter 3, 14
- Sensor,
 - Installation, 21, 29
 - Wiring, 29
- Series 922 Input and Output Overview, 7, Fig. 1
- SETUP, 45
- Shipping Claims, 86
- Specifications, 68
- SS Relay Output Wiring, 31, Fig. 22
- SS Switch Output Wiring, 31, Fig. 23
- Steps To Put Your Control To Work, 8
- SYSTEM, 42
- System,Wiring Example, 35, Fig. 29

T

- Table of Contents, 3
- Thermocouple Calibration, 71
- Thermocouple Sensor Wiring,
 - TC/ Process, 30, Fig. 19
 - Dual TC, 31, Fig. 21
- Tuning, 37
 - Reference, 36

U, V

- Vaisala sensor, 21

W

- WAITFOR Step, 19
- Warranty, 85
- Watlow Controls, 86
- Where To Go From Here, 11, 12, 20
- Wiring Example, 35, Fig. 29

Warranty Information

The Watlow Series 922 is warranted to be free of defects in material and workmanship for 36 months after delivery to the first purchaser for use, providing that the units have not been misapplied.

Since Watlow has no control over their use, and sometimes misuse, we cannot guarantee against failure. Watlow's obligations hereunder, at Watlow's option, are limited to replacement, repair or refund of purchase price, any parts which upon examination prove to be defective within the warranty period specified. This warranty does not apply to damage resulting from transportation, alteration, misuse or abuse.

Returning Merchandise

The following procedure applies for any products returned to the factory:

1. You must call Watlow Customer Service, 507/454-5300, for a Return Material Authorization (RMA) number before returning any item for repair. We need this information:
 - Ship to address
 - Bill to address
 - Contact name
 - Phone number
 - Ship via
 - Your P.O. number
 - Symptoms and/or special instructions
 - Name and phone number of person returning the material.We will not accept a return without an RMA number. The RMA number must appear on the outside of the carton and on all paperwork. Cartons without RMA numbers will be returned. Ship on a freight prepaid basis.
2. You need prior approval and an RMA number from the Customer Service Department when you are returning an unused product for credit. Also, we must apply a 20 percent restocking charge for all returned stock controls and accessories.
3. After we receive your return, we will enter a repair order, replacement order, or issue credit for material.
4. In cases of manufacturing defect, we will return it to you with a letter of explanation. Repair costs will not exceed 50 percent of the original cost.

Shipping Claims

When you receive your Watlow control, examine the package for any signs of external damage it may have sustained enroute. If there is apparent damage either outside the box or to its contents, make a claim with the shipper immediately. Save the original shipping carton and the packing material.

Watlow Controls

Watlow Controls is a division of Watlow Electric Manufacturing Company of St. Louis, Missouri. Watlow is an established manufacturer of industrial electric heating products, in business since 1922. Watlow boasts the ability to begin with a full set of specifications and to complete an industrial product that is manufactured totally in-house, in the U.S.A. Products designed and manufactured by Watlow are electric heating elements, sensors, electronic temperature controls and power switching devices.

The Winona operation has been designing solid state electronic control devices since 1962, and has earned the reputation as an excellent supplier to original equipment manufacturers. These OEMs depend upon Watlow Controls to provide compatibly engineered controls which they can incorporate into their products with confidence.

Watlow Controls resides in a 100,000 square foot marketing, engineering and manufacturing facility in Winona, Minnesota.

Series 922 Error Codes/Alarms

ER1 Error Codes and Actions

- 1 Internal RAM failure. Contact factory.
- 2 External RAM failure. Contact factory.
- 3 Bad battery error. Contact factory.
- 4 Channel 1 A/D conversion error; check sensor or contact factory.
- 5 Channel 2 A/D conversion error; check sensor or contact factory.
- 6 Ground A/D conversion error; contact factory.
- 7 High reference A/D conversion error, contact factory.
- 8 Channel 1 interpolation/overrange. Check specification for sensor input range.
- 9 Channel 2 interpolation/overrange. Check specification for sensor input range.
- 10 D/A gain error. Contact factory.
- 11 Channel 1 zero error. Contact factory.
- 12 Channel 1 gain error. Contact factory.
- 14 Channel 2 zero error. Contact factory.
- 15 Channel 2 gain error. Contact factory.
- 18 Stack overflow error. Contact factory.

NOTE: If an error or alarm flashes on the display, press the enter key to stop the flashing for 5 minutes. To clear the alarm or error, go to the system menu and press enter on the appropriate prompt.

ER2 Error Codes and Actions

- 1 922 transmit buffer overflow. Clear error, retransmit.
- 2 922 receiver buffer overflow. Protocol or syntax violation, retransmit.
- 3 Framing/overrun error. Check baud rate, parity, stop bits.
- 5 Parity error. Check baud rate, parity, stop bits.
- 6 Talking out of turn. STX protocol violation, retransmit.
- 7 Invalid reply error. Figure out communications, retransmit.
- 20 Command not found. Check your program.
- 21 Parameter not found. Check your program.
- 22 Incomplete command line. Syntax error, retransmit.
- 23 Invalid character. Syntax error, retransmit.
- 24 Number of characters overflow. Numeric syntax error, retransmit.
- 25 Input out of limit. Transmitted value too large or small, retransmit.
- 26 Read only command. Cannot input a value for that parameter, retransmit.
- 27 No Channel 2 available error.
- 28 Write only error. A read was attempted on a parameter that can only be written to.
- 30 Request to run invalid. Verify a run condition.
- 31 Request to hold invalid. Verify a hold condition.
- 32 Command invalid in run mode. Cannot enter values in run mode, retransmit.
- 33 Self test mode not active. Check to see that DIP switch #6 is ON.
- 35 Number of steps stored is > or = to 99. Enter steps only to 99.
- 36 No file found. Check your program, retransmit.
- 37 No step found. Check your program.
- 38 No asterisk input allowed. Follow proper format for entering asterisks.
- 39 Infinite loop error. Check the number of consecutive loops, retransmit.
- 40 File change error. An attempt to resume a changed file occurred. Check your program.

Series 922 Response to Error Codes

ER1 Codes Shut Down Outputs

The Series 922 will shut down its outputs whenever an ER1 code occurs. An ER1 code usually represents a Series 922 malfunction.

Check These Items First

Anytime you see an ER1 error code, check for these four items first, then follow the recommended action listed by the code:

- Low line voltage
- Noisy environment, noise event
- Vibration
- Temperature or moisture over specification

ER2 Codes Do Not Shut Down Outputs

ER2 error codes are data communication system related or file programming related.

Series 922 Alarm Messages

ALM1___HI occurring
ALM1___LO occurring
ALM2___HI occurring
ALM2___LO occurring

Clearing an Error Code

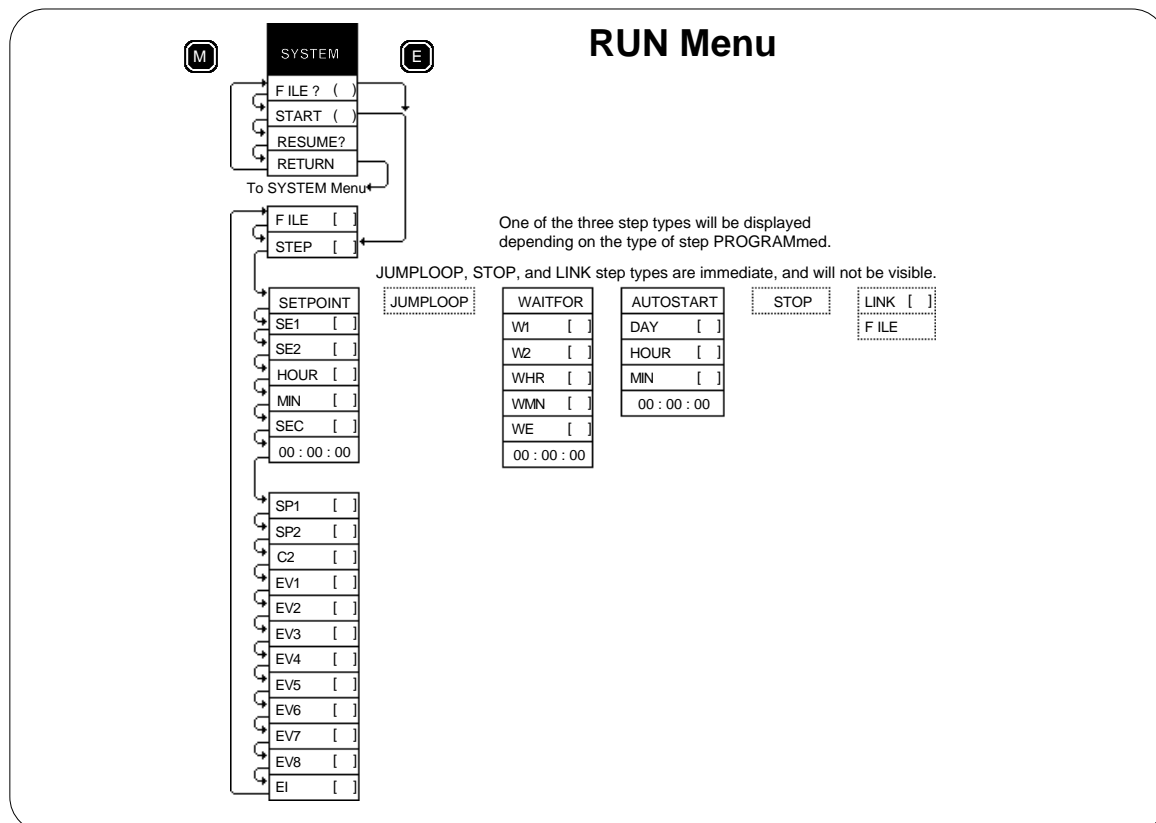
To clear an Error Code from the alphanumeric display, first correct the problem, then return to the SYSTEM menu. Use the UP/DOWN keys to reach the ER1 or ER2 parameter and press ENTER. Press ENTER or transmit a 0. If the code returns, or if the 922 replies to a data communicated "? ER1" or "? ER2" query with the same code, the problem still exists. Refer to the Series 922 manual.

ER1 error codes can only be cleared when in the SYSTEM prompt and ER1 XX is flashing.

ER2 error codes can be cleared by returning to the SYSTEM menu, or by pressing the ENTER key while in the RUN mode.

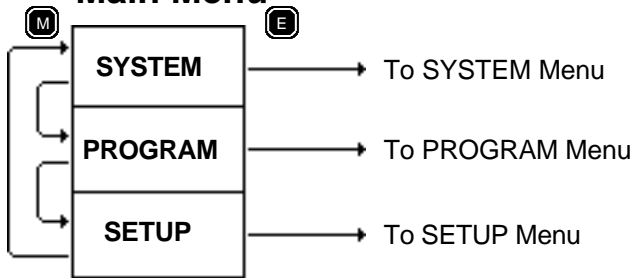
How to Clear an Alarm Code

An alarm code will alternately flash with the parameter that you are presently on. If the LAT alarm value is NLAT, your alarms are non-latching and will clear automatically when the ACTUAL display value returns to within the normal operating band. If LAT = LAT, the alarms are latching, and must be cleared. Alarm conditions can be cleared, by pressing the ENTER key, while in the RUN mode, or in the CLR ALARM parameter

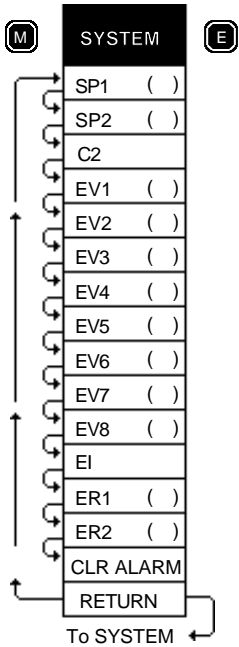


Series 922 Quick Reference

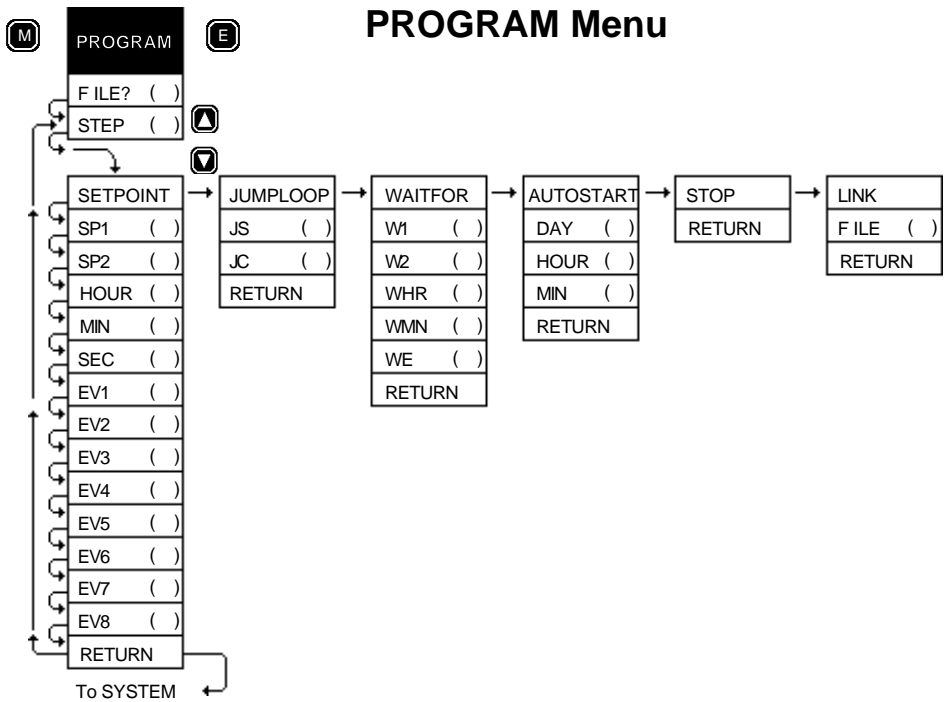
Main Menu



SYSTEM Menu



PROGRAM Menu



Notes

Watlow Series 922 User's Manual

Watlow Controls, 1241 Bundy Blvd., P.O. Box 5580, Winona, MN 55987-5580, Phone: 507/454-5300, Fax: 507/452-4507

How To Use Data Communications with the Watlow Series 922



User's Manual



WATLOW

Watlow Controls, 1241 Bundy Blvd., Winona, MN 55987, Phone: 507/454-5300, Fax: 507/452-4507

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Contents

Page	Item
3	How to Use Data Communications with the Watlow Series 922
3	Two Serial Hardware Interfaces and Two Software Protocols
3	Communications Wiring
4	RS-422A Interface Pinouts
4	RS-423A Interface Pinouts (RS-232C Compatible)
4	Network Connections
5	Connecting the Control and the Computer
5	Communications Software
5	Series 922 Communications Parameters
5	ASCII and Series 922 Information
7	Series 922 General Message Syntax
7	Message Syntax
7	Data Rules
8	Command List
8	Example Format
9	XON/XOFF Protocol for RS-423A
9	How to Start and Stop Communicating with the Series 922 and XON/XOFF
10	XON/XOFF "=" Command Example
11	XON/XOFF "?" Command Example
12	ANSI X3.28 Protocol
12	Device Address
12	Starting Communications in ANSI X3.28 Protocol
13	Stopping Communications in ANSI X3.28 Protocol
13	ANSI X3.28 "=" Command Example
14	ANSI X3.28 "?" Command Example
16	"?" Command
16	"=" Command
19	Other ? or = Commands
19	"=STRT" Command
19	"=HOLD" Command
19	"=RSUM" Command
19	"?FST" Command
20	"=STP" Command
21	"?STP" Command
22	"?MTR" Command
23	"?AFL" Command
23	"=TI" Command
23	"?TI" Command
24	"=CLRF" Command
24	NAKs and Error Codes
24	That's All There Is To It
25	Index
27	Watlow Controls

Figures	Item
1	RS-422 Interface, Pin Designations
2	RS-423 Interface, Pin Designations
3	Series 922 General Message Syntax Example
4	XON/XOFF "=" Command Example
5	XON/XOFF "?" Command Example
6	ANSI X3.28 "=" Command Example
7	ANSI X3.28 "?" Command Example

Tables	Item
1	ASCII Character Set
2	ASCII Control Characters (Partial Set)
3	"?" Command Data and Responses, Partial Set
4	"=" Command and "?" Command Data
5	"=STP" Command Data
6	"?STP" Command Response Data
7	"?MTR" Command Response Data

How to Use Data Communications with the Watlow Series 922

This manual is a supplement to the Series 922 User's Manual. It is for users with the data communications option; use in conjunction with the Series 922 User's Manual.

This is expert user-level material and requires previous experience with data communications.

Two Serial Hardware Interfaces and Two Software Protocols

Depending on your units model number, you may have one of two hardware interfaces:

- 1) **RS-422A** for a "multidrop" or (multiple device) network, up to ten devices total; with 4000' network length limit, (922A-XXX0--C000) or
- 2) **RS-423A (RS-232C compatible)** (922A-XXX0-B000) for one on one communication on a 50' network with a 922 and a host computer.

There are two protocols available to you, both work with either interface. But depending on the type of network you need, you must use the correct combination of interface and protocol.

We use **ANSI X3.28 Protocol**, based on ANSI X3.28 - 1976 Subcategories 2.2, and A3, with the RS-422A interface to run a multiple device network. We also use **XON/XOFF Protocol**, a simpler protocol, to run a two device network with an RS-423A interface. XON/XOFF Protocol requires no responses to messages like the ANSI X3.28 Protocol does. XON/XOFF will also work with the RS-422A interface, but the network is limited to two devices. Likewise, ANSI X3.28 Protocol, which provides a response to every message, will work with the RS-423 interface. But again you are limited to two devices.

If you haven't already done so, please read "Introduction to Data Communications with WATLOW Controls" (shipped with your communications-equipped Series 922).

To select which protocol you are going to use, go into the SPCLFUNC parameters under the SETUP menu, ACCESS (5). Use the UP/DOWN keys and advance to the COM parameter. Select either XON, for the XON-XOFF communications protocol, or STX for ANSI X3.28 2.2 - A3.

If you are using ANSI X3.28 Protocol, choose an address number for the control.

Communications Wiring

To connect your Series 922 to a computer, use the next page as a reference. Your computer hardware manual will provide the serial port pin information. Also refer to the noise prevention section in Chapter 2 of the Series 922 User's Manual. In the often noisy environments of industrial locations, it is important not to take noise isolation lightly.

Wire Data Comm

Figure 1 -
RS-422 Interface, Pin
Designations.

Series 922
DB-9 Female
with respect
to the Series 922



1 CAUTION:

When referencing
SIGNAL COMMON(s)
to ground, terminate
at one point only at
the host computer
according to the
host's hardware
specifications.



2 CAUTION:

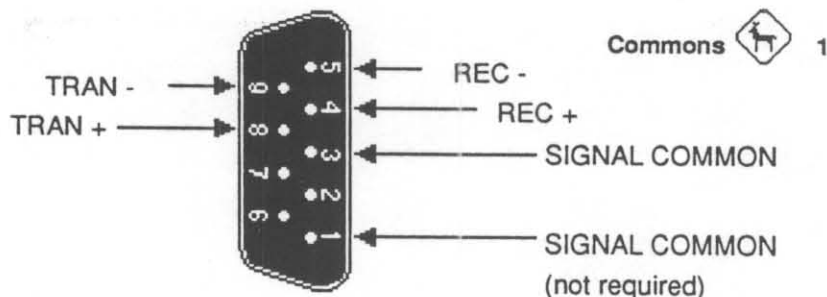
Do not connect or
terminate a commu-
nication cable shield
to any part of the
control or its panel.
Reference all cable
shields to a single
ground point at the
host computer ac-
cording to the host's
hardware specifica-
tions.

Figure 2 -
RS-423 Interface, Pin
Designations.

Series 922
DB-9 Female
with respect
to the Series 922.

RS-422A Interface Pinouts

922A-XXXX-C000

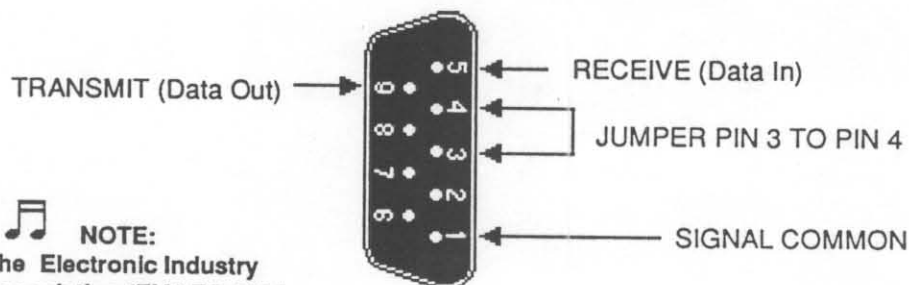


NOTE:

The Electronic Industry Association (EIA)
RS-422A standard recommends a maximum
4000 ft. (1200mm) total network distance.

RS-423A Interface Pinouts (RS-232C Compatible)

922A-XXXX-B000



NOTE:

The Electronic Industry
Association (EIA) RS-423A
standard recommends a
maximum 50 foot total
point-to-point distance.

Network Connections

You can connect a data communication equipped Series 922 to any computer with an RS-422A or RS-423A (RS-232C compatible) serial interface. The serial interface is the key. The IBM™ PC® with an RS-232C serial output card, for instance, will talk to a single RS-423A equipped Series 922. For a multiple 922 network with the same PC, you'll need an RS-232/RS-422 converter to act as a "bus," or multiple connection point. Watlow recommends the Burr-Brown LDM 422 for that purpose. The address is: Burr-Brown, Inc., 1141 West Grand Rd., Suite 131, Tucson, AZ 85705, Phone: (602) 624-2434, Fax: (602) 623-8965

Connecting the Control and the Computer

Remove power from both the Series 922 and your computer before connecting them together. This prevents noise or static interference entering the data communication lines.

As soon as you connect the data communications line(s), you're ready to apply power to your system.

Communications Software

If you want to write your own communications software for the Series 922, or edit the program, you will be able to do that with the information provided in this chapter.

Series 922 Communication Parameters

To communicate with the Series 922, set your computer for these parameters:

Baud Rate = 1200, 2400, 4800, 9600 (choose one)
Parity = Odd
Data Bits = 7
Start Bits = 1
Stop Bits = 1

All the parameters listed above are factory selected except the Baud Rate parameter. Baud Rate is found under the SPCLFUNC menu in the BAUD parameter.

ASCII and Series 922 Information

The next page shows you ASCII and control key equivalent tables. Following that, you will find a detailed explanation of the Series 922 syntax and command structure for each of the two protocols.

ASCII Char.

Table 1 -
ASCII Character
Set.

ASCII Character Set											
Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
00	00	NUL	16	10	DLE	32	20	SP	48	30	0
01	01	SOH	17	11	DC1	33	21	!	49	31	1
02	02	STX	18	12	DC2	34	22	"	50	32	2
03	03	ETX	19	13	DC3	35	23	#	51	33	3
04	04	EOT	20	14	DC4	36	24	\$	52	34	4
05	05	ENQ	21	15	NAK	37	25	%	53	35	5
06	06	ACK	22	16	SYN	38	26	&	54	36	6
07	07	BEL	23	17	ETB	39	27	'	55	37	7
08	08	BS	24	18	CAN	40	28	(	56	38	8
09	09	HT	25	19	EM	41	29	)	57	39	9
10	0A	LF	26	1A	SUB	42	2A	*	58	3A	:
11	0B	VT	27	1B	ESC	43	2B	+	59	3B	;
12	0C	FF	28	1C	FS	44	2C	,	60	3C	<
13	0D	CR	29	1D	GS	45	2D	-	61	3D	=
14	0E	SO	30	1E	RS	46	2E	.	62	3E	>
15	0F	SI	31	1F	US	47	2F	/	63	3F	?
Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
64	40	@	80	50	P	96	60	`	112	70	p
65	41	A	81	51	Q	97	61	a	113	71	q
66	42	B	82	52	R	98	62	b	114	72	r
67	43	C	83	53	S	99	63	c	115	73	s
68	44	D	84	54	T	100	64	d	116	74	t
69	45	E	85	55	U	101	65	e	117	75	u
70	46	F	86	56	V	102	66	f	118	76	v
71	47	G	87	57	W	103	67	g	119	77	w
72	48	H	88	58	X	104	68	h	120	78	x
73	49	I	89	59	Y	105	69	i	121	79	y
74	4A	J	90	5A	Z	106	6A	j	122	7A	z
75	4B	K	91	5B	[	107	6B	k	123	7B	{
76	4C	L	92	5C	\	108	6C	l	124	7C	|
77	4D	M	93	5D	]	109	6D	m	125	7D	}
78	4E	N	94	5E	^	110	6E	n	126	7E	~
79	4F	O	95	5F	_	111	6F	o	127	7F	DEL

Table 2 -
ASCII Control
Characters.
(Partial Set)

ASCII Control Characters (Partial Set)				
ASCII Char.	Ctrl Key Equiv.	Definition	Dec. Equiv.	Hex. Equiv.
ENQ	Ctrl E	Enquiry	5	05
ACK	Ctrl F	Acknowledge	6	06
NAK	Ctrl U	Neg. Acknowledge	21	15
STX	Ctrl B	Start of Text	2	02
ETX	Ctrl C	End of Text	3	03
EOT	Ctrl D	End of Transmission	4	04
DLE	Ctrl P	Data Link Escape	16	10
CR	Ctrl M	Carriage Return	13	0D
DC1	Ctrl Q	XON	17	11
DC3	Ctrl S	XOFF	19	13

Series 922 General Message Syntax

As soon as you link the devices, you'll be able to talk to the Series 922 using ASCII characters.

The Series 922 will respond to any parameter showing in the alphanumeric display, plus some others. The control will respond to either upper or lower case ASCII characters from your computer keyboard.

Both protocol/interface combinations will respond to the general syntax, providing the commands or queries are correctly transmitted. However, the ANSI X3.28 Protocol requires beginning and ending characters, and the XON/XOFF Protocol requires ending characters. We'll look at those shortly.

Message Syntax

Messages from your computer to the Series 922 must take this general form. All commands do not require the full number of data fields.

Command <Space> Data.1 <Space> Data.2 <Space> Data.3... Data.N

"Command" is a character set to which the Series 922 will respond. The brackets "< >" enclose a non-literal description. "Space" is simply a delimiter, an ASCII space character (Hex 20). "Data Fields" are parameters and values specific to a command; the number of possible data fields depends on the particular command you use. Data 1 is here abbreviated, "Data.1", Data 2 is "Data.2" and so on.

In the syntax explanations ahead, we'll show you the specific arguments for each command. It will speed the process, though, if you remember this general syntax.

Data Rules

Data fields are parameters and values specific to particular commands. These rules govern their use. Specific data for each command is listed later in this chapter.

- Data will be ASCII 0 through 9, unless otherwise noted.
- Data can go up to four total characters, including a minus sign.
- Data can use leading zeros. (Up to 4 digits.)
- Data does not use decimal points, therefore, a number must have units equal to the least significance of the data value. If, for example, a parameter's value is 1, and the least significant digit of the parameter is 0.1, the number sent as the data would be 10. That is to say the value is interpreted as 10 tenths.
- Data sent to or returned from the unit (to parameters that will accept it) that has a value of "*" (asterisk), means that the value is unprogrammed.

Command List

These commands, represented by their respective ASCII characters, will enable you to program the Series 922 from your computer keyboard. More detailed descriptions of the commands are on the pages noted.

?	Finds the value of a specific parameter.	p. 16
=	Sets a specific parameter to a specific value.	p. 16

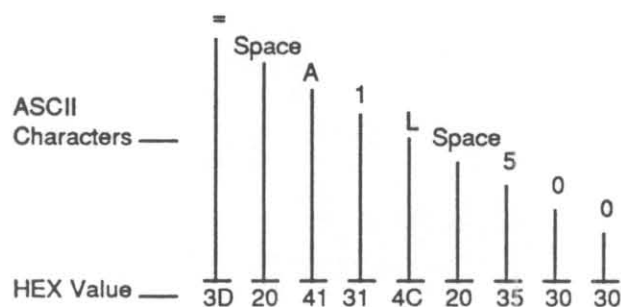
Example Format

For your benefit, we're presenting message/response examples with syntax required for Series 922 communication. Information bracketed by < > indicates a description, rather than literal characters. We show each ASCII character that you must transmit to the Series 922, including space between the characters. (A "space" is itself an ASCII character, hex 20). For clarity, we also represent each ASCII character as a hexadecimal pair. The pairs are spread apart on the page for easy reading. However, electronic devices "see" the hex pairs all together in "strings," with no spaces in between.

For instance, from the example just below, you want to set the Alarm 1 Low (A1L) parameter to 500°. Notice the syntax just below which uses the "=" command.

= <Space> A1L <Space> 500

**Figure 3 -
Series 922
General Message
Syntax Example.**



To send the message on Page 8, Figure 4, you key the ASCII characters into your computer, or write them into your program. The computer, in turn, will send a string similar to the one at the bottom of the example, 3D2041314C20353030.

Notice that we haven't mentioned protocol here, or any characters added to this syntax by a protocol. With XON/XOFF, the message above can be transmitted with only an additional Carriage Return <CR> (hex 0D) character at the end. However, the ANSI X3.28 Protocol requires an envelope of Start of Text <STX> (hex 02) and End of Text <ETX> (hex 03) characters around the information you see above. You'll learn how to do that in the pages ahead.

XON/XOFF Protocol for RS-423A

XON/XOFF (flow control) Protocol allows a communicating device (either a 922 or the host) to suspend transmission of all messages from the other device, and then to continue transmission when it's again ready.

The device that needs to suspend transmission sends the XOFF character (hex 13) to stop the other device's transmitter, and XON (hex 11) to restart it. Note that technically any character will restart the transmitter, but only the XON character is not a part of any regular message that may be transferring.

Messages transmit according to the syntax described in the XON/XOFF formats which follow for each command.

The XON/XOFF Protocol requires a Carriage Return character (hex 0D) at the end of every message.

How To Start and Stop Communicating with the Series 922 and XON/XOFF

Starting communication with **XON/XOFF Protocol** is simple. You just configure your computer to agree with the Series 922 communication parameters and open its serial communication port in software. Then begin to "talk" by transmitting a message to the Series 922. You stop communicating with XON/XOFF Protocol simply by ceasing to send messages.

XON/XOFF "=" Command Example

The general command syntax is the one you've already seen. Each command uses a slightly different variation of it, depending on the number of arguments required for a message. The control must be in the HOLD mode to accept a change.

- You want to change the Alarm 1 Low (A1L) value to 500°. The "=" Command will do the job.

The syntax with XON/XOFF Protocol requires an ending Carriage Return <CR>.

"=" Command Syntax with XON/XOFF Protocol:

= <space> Data.1 <space> Data.2 <CR>

With the "=" Command, Data.1 is the Series 922 parameter, in this case Alarm 1 Low, A1L. Data.2 is the value you want to set for that parameter, in this example, 500.

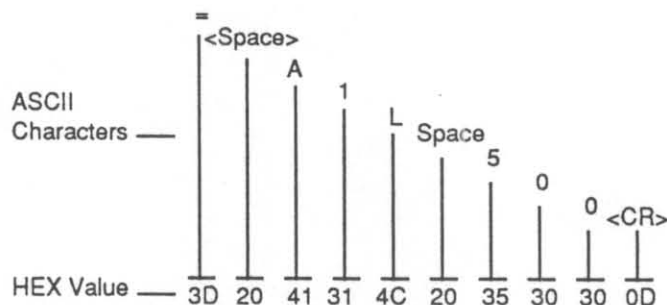
Enter in ASCII:

= <space> A1L <space> 500 <CR>

The hex string will be:

3D2041314C203530300D

Figure 5 -
XON/XOFF "="
Command Example.



Response from the Series 922:

Sends a "XOFF" when a carriage return is received and then an "XON" when the unit is done processing the command.

- The complete list of "=" Command data (parameters and value limits) is in Table 6, Pages 20 - 21.

XON/XOFF "?" Command Example

You want to know the Alarm 1 Low (A1L) value. The "?" uses a variation of the message syntax shown just below. **This protocol requires an ending carriage return character.**

"?" Command syntax with XON/XOFF Protocol:
? <space> Data.1 <CR>

Enter in ASCII:
? <space> A1L <CR>
 The hex string will be:
 3F2041314C0D

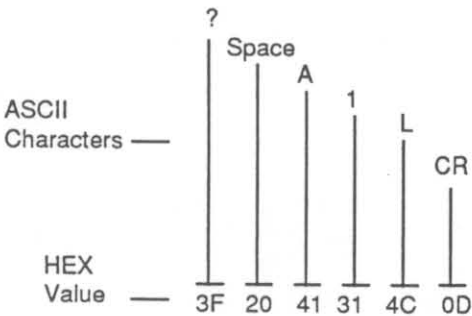
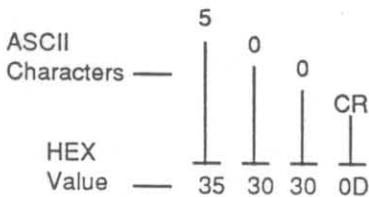


Figure 5 -
XON/XOFF "?"
Command Example.

The value of A1L will be between R1L (Range Low) and R1H (Range High), say, 500.

Response from the Series 922:
 <XOFF> <XON> <current value of A1L> <CR>

The hex response string is:
 3530300D



ANSI X3.28 Protocol

The ANSI X3.28 Protocol provides high quality communications by requiring a response to every message. With a multiple device or "multidrop" network, this protocol prevents confusion among the separate devices. Furthermore, if noise occurs somewhere in the system, no parameter will change because noise can't comply with the protocol.

By placing messages inside a protocol envelope, the messages are protected. In the examples to come you'll see how this works.

The ANSI X3.28 Protocol requires STX characters at the beginning of a message and ETX characters at the end.

Device Address

If you are using the ANSI X3.28 Protocol, you must have a device address (identification) number. A Watlow RS-422A multidrop network can handle up to 10 devices with this protocol. Set the address number with the Series 922 PROGRAM - SPCLFUNC menu (ACCESS 5), at the COM ID parameter.

Starting Communications in ANSI X3.28 Protocol

Here's the syntax for starting communications with ANSI X3.28 Protocol. The master device, your computer, must initiate the data link. The example below uses the ASCII number 4 as a Series 922 device address.

Enter in ASCII, using this syntax: <Address # 4><ENQ>

ASCII		4	
Characters	—	|	<ENQ>
		└─	└─
HEX Value	—	34	05

Response from the 922:

<Address # 4><Acknowledge (ACK)>

ASCII		4	
Characters	—	|	<ACK>
		└─	└─
HEX Value	—	34	06

Stopping Communications in ANSI X3.28 Protocol

The master device, your computer, must end communications with Device #4 by using Data Link Escape (DLE) and End of Transmission (EOT) characters.

Enter in ASCII: <DLE><EOT>

ASCII Characters	—	<DLE>	<EOT>
HEX Value	—	10	04

Response from the 922:
None

ANSI X3.28 "=" Command Example

The "=" Command sets a specific 922 parameter to a specific value. The control must be in the HOLD mode to accept the change. The general command syntax applies to all commands. The definition and number of arguments depends on the command itself. See Table 4, Pages 17 - 18.

In this example, you want to change the Alarm 1 Low value to 500°. Here, the "=" Command will do the job.

"=" Command Syntax with ANSI X3.28 Protocol:
<STX> = <space> Data.1 <space> Data.2 <ETX>

With the "=" Command, Data.1 is the Series 922 parameter, in this case Alarm 1 Low, A1L. Data.2 is the value you want to set for that parameter, in this example, 500.

Enter in ASCII:
<STX> = <space> A1L <space> 500 <optional carriage return> <ETX>
The hex string is:
023D2041314C2035303030

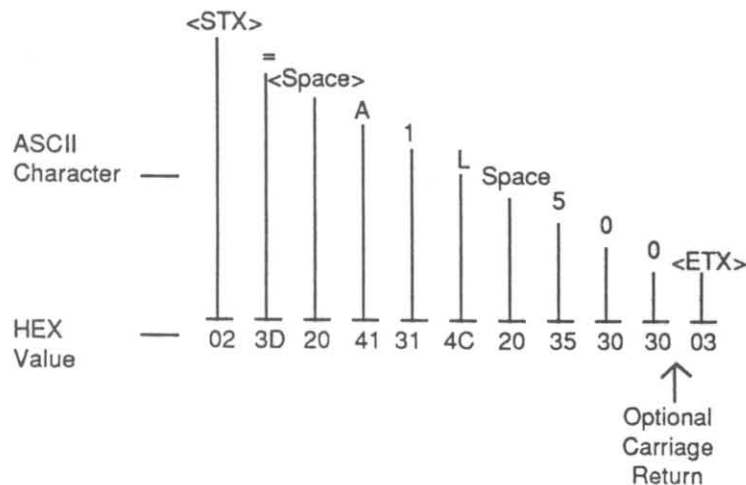


Figure 6 -
ANSI X3.28 "="
Command Example.

ANSI X3.28 "?"

Response from the Series 922:

<ACK>

The hex response string is:

06

- You'll find the the complete list of "=" Command arguments (parameters and value limits) in Table 4, Pages 17 - 18.

ANSI X3.28 "?" Command Example

You need to know the Alarm 1 Low value (A1L). The "?" uses a variation of the message syntax shown just below. **This syntax requires the protocol start of text and end of text characters.**

"?" Command syntax with ANSI X3.28 Protocol:

<STX> ?<space> <Data.1> <ETX>

Enter in ASCII:

<STX> ? <space> <A1L> <optional carriage return> <ETX>

The hex string will be:

023F2041314C03

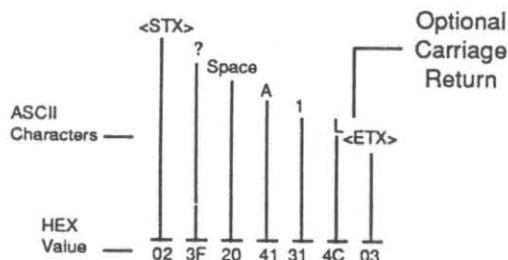


Figure 7 -
ANSI X3.28 "?"
Command Example.

First response from the Series 922:

<ACK>

The <ACK> hex response string is:

06

Your computer's confirming response:

<EOT>

The <EOT> response hex string is:

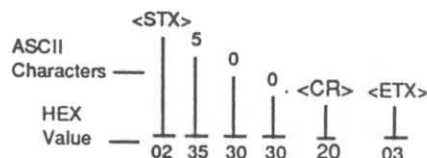
04

Second response from the Series 922:

<STX> <current A1L value> <carriage return> <ETX>

The hex string is:

023530302003



Your computer's next response:

<ACK> or <NAK> (if the message needs to be repeated).

The hex string is:

06 or 15

Final response from the Series 922:

<EOT>

The hex string is:

04

Data.1	Resps	Information	Comments
C1	ACTUAL	Actual process value	Between R1L and R1H
C2	ACTUAL	Actual process value	Between R2L and R2H
ALM	0 1 2 4 8	No alarms occurring A1H occurring A1L occurring A2H occurring A2L occurring	Cleared when alarm is read
AUX1	0 1	AUX1 is an Alarm Output AUX1 is an Event Output	
AUX2	0 1	AUX2 is an Alarm Output AUX2 is an Event Output	
DIP	3F 1F F 7 3 1 0	All DIP Switches ON DIP Switch 1 OFF DIP Switch 1-2 OFF DIP Switch 1-3 OFF DIP Switch 1-4 OFF DIP Switch 1-5 OFF DIP Switch 1-6 OFF	
EI	1 0	Closed external event status Open external event status	
IN	1 2 3 4 5 6 7	Dual RTD RTD / Process T/C / Process Dual Process Dual T/C Dual RTD 0.1 0.1 RTD/Process	
KEY	0 1 2 4 8 10	None Mode Enter Increment Decrement Run/Hold	Cleared when key is read
OUT	0 1	Heat / Cool Cool / Heat	
RUN	0 1	HOLD mode RUN mode	
TYP	0 1 2 3 4 5	T/H T/T T/P T P/P P	
FST	1 - 99	Finds number of steps in a file.	
STP	See Page 20.	Finds data programmed in step.	
MTR	See Page 22.	Monitors a RUN or HOLD step.	
AFL	1 - 10	Finds all programmed files.	
TI	HR, MIN, SEC	Finds real time, hours, min, sec.	
MDL		Model # and Revision #.	

Table 3 -
"?" Command
Data and
Responses,
Partial Set. See
Table 4 for more
"?" Command Data.

Commands

Table 3 -
Continued

Data.1	Respns	Information	Comments
ER1	0	No error	Cleared when ER1 is read
	1	Internal RAM error	
	2	External RAM error	
	3	Bad battery error	
	4	Ch. 1 A/D conversion error	
	5	Ch. 2 A/D conversion error	
	6	Ground A/D conversion error	
	7	High reference A/D error	
	8	Interpolation/Ovrange Ch. 1	
	9	Interpolation/Ovrange Ch. 2	
	10	D/A gain error	
	11	Channel 1 zero error	
	12	Channel 1 gain error	
	14	Channel 2 zero error	
	15	Channel 2 gain error	
	18	Stack overflow error	
ER2	0	No error	Cleared when ER2 is read
	1	Transmit buffer overflow	
	2	Receive buffer overflow	
	3	Framing/overrun error	
	5	Parity error	
	6	Talking out of turn	
	7	Invalid reply error	
	20	Command not found	
	21	Parameter not found	
	22	Incomplete command line	
	23	Invalid character	
	24	Number of chars. overflow	
	25	Input out of limit	
	26	Read only command	
	27	No Channel 2 available error	
	28	Write allowed only	
	30	Request to RUN invalid	
	31	Request to HOLD invalid	
	32	Command invalid RUN mode	
	33	Self test mode not active	
	34	Memory write not successful	
	35	Number of steps stored is ≥ 99	
	36	No file found	
	37	No step found	
	38	No asterisk input allowed	
	39	Infinite loop error	
	40	File change error	

"?" Command

The "?" Command finds the specific value of a Series 922 parameter (Data.1). Tables 3 and 4 provide the complete list of parameters you may use, plus responses. You may use the "?" Command in either the RUN or HOLD modes. Data returned from the unit, with a value of "*" (asterisk), are unprogrammed parameters.



NOTE:

You may write to a Series 922 parameter with the "=" Command only when the unit is in the HOLD mode.

"=" Command

"The "=" Command sets a specific Series 922 parameter (Data.1) to a specific value (Data.2) when the unit is in the HOLD mode. Use Tables 3 and 4 to select parameters (Data.1) in the lefthand column, with low and high limit or code values (Data.2) in the three center columns. Use the table with either syntax.

Data.1	Data.2			
	Low Limit	High Limit	Code	Function
AXH	RXL value Process ± 555 /Deviation ± 999	RXH value		Set Alarm X High value
AXL	RXL value Process ± 555 /Deviation ± 999	RXH value		Set Alarm X Low value
ALM	0 1 2 4 8	No alarms occurring A1H occurring A1L occurring A2H occurring A2L occurring		
ALT	0	5000		Set altitude for humidity.
ANLG	0	3	0 1 2 3	SP1 retransmit SP2 retransmit CH1 retransmit CH2 retransmit
AT1	0	1	0 1	Set Alarm 1 to process Set Alarm 1 to deviation
AT2	0	1	0 1	Set alarm 2 to process Set Alarm 2 to deviation
AUX1	0 1	AUX1 is an Alarm Output AUX1 is an Event Output		
AUX2	0 1	AUX2 is an Alarm Output AUX2 is an Event Output		
CALX*	-90°F -50°C -50 Units -50 % RH	90°F 50°C 50 Units 50 % RH		Set Calibration offset
CFU	0	2	0 1 2	Display °F Display °C Display Units (PVUs)
CLRF	1	10		Clears a designated file from memory
CTXC	1	60		Set Cycle Time-Cool
CTXH	1	60		Set Cycle Time-Heat
DBX*	-36°F -20°C -20 Units -20 % RH	36°F 20°C 20 Units 20 % RH		Set Dead Band
EV1		0 1	0 1	Set EV1 OFF Set EV1 ON
EV2		0 1	0 1	Set EV2 OFF Set EV2 ON
EV3		0 1	0 1	Set EV1 OFF Set EV2 ON

Commands



NOTE:

An **X** means that it applies to either Channel 1 or Channel 2.

Table 4 -
"=" Command
and "?" Command
Data. See Table 6
for more "?" Com-
mand Data.

* When the 922 RTD Input is 0.1°, these parameters will have an implied decimal point to the left of the least significant digit.

Commands

Table 4 -
Continued

* When the 922 RTD Input is 0.1°, these parameters will have an implied decimal point to the left of the least significant digit.

Data.1	Data.2			
	Low Limit	High Limit	Code	Function
EV4	0	1	0 1	Set EV1 OFF Set EV2 ON
EV5	0	1	0 1	Set EV1 OFF Set EV2 ON
EV6	0	1	0 1	Set EV1 OFF Set EV2 ON
EV7	0	1	0 1	Set EV1 OFF Set EV2 ON
EV8	0	1	0 1	Set EV1 OFF Set EV2 ON
GS*	0°	18°F 10°C 10 Units 10 % RH		Set Guaranteed Soak
HOLD	1	1	1	Holds Program
LAT	0	1	1 0	Set Latched alarms Set non-latched alarms
LOCK	0	2		Lock front panel
PBXC*	0	900°F 500°C 500 Units 500 % RH		Set Prop. Band-Cool
RBXC	0	7		Set Rate Band-Cool
PBXH*	0	900°F 500°C 500 Units 500 % RH		Set Prop. Band-Heat
RXH	Min. IN range	Max. IN range		Set Range High
RXL	Min. IN range	Max. IN range		Set Range Low
RSXC	0	500		Set Reset-Cool
RSXH	0	500		Set Reset- Heat
RSUM	1	1	1	Resumes a holding program
RTXC	0	500		Set Rate-Cool
RTXH	0	500		Set Rate-Heat
SCAL	0	3	0 1 2 3	1mV per LSD 2mV per LSD 5mV per LSD 10mV per LSD
SPX	RXL	RXH		Enter fixed Set Point
STRT	See Page 19			Start Program

Other ? or = Commands

The following commands also require extra protocol characters with the syntax depending on the protocol you are using. Add Start of Text and End of Text Characters to the syntax with ANSI X3.28 Protocol, or the ending Carriage Return character to the syntax with XON/XOFF Protocol. The protocol characters are not shown in these commands, but nonetheless, must be used.

"= STRT" Command

This command causes a 922 program to start. If the program is already RUNNING, an error will occur.

The syntax for this command (not including protocol characters) is:
= <Space> STRT <Space> <File#> <Space> <Step#>

Check the RUN/HOLD status with the "? RUN" command.

"= HOLD" Command

This command causes a 922 program to HOLD. If the program is already HOLDing, an error will occur.

The syntax for this command (not including protocol characters) is:
= <Space> HOLD <Space> 1

Check the HOLD status with "? RUN".

"= RSUM" Command

This command causes a Series 922 program to RESUME. If the program is already RUNNING, an error will occur.

The syntax for this command (not including protocol characters) is:
= <Space> RSUM <Space> 1

Check the RUN status with "? RUN".

"? FST" Command

This command asks the number of steps programmed in the specified file.

The syntax for this command (not including protocol characters) is:
? <Space> FST <Space> <File #>

This command will return the number of programmed steps in the specified file in a one or two character ASCII number.

"= STP"

"= STP" Command

The "= STP" command is used to program a given step in a file. Remember that total program space is 99 steps. You can use the "=STP" command only in the HOLD mode.

The syntax for this command (not including protocol characters) is:
= <Space> STP <space><File#><space><Step#><space><Step Type Code><space><Data.4><space><Data.5><space>...<Data.n>



NOTE:

You may write to a Series 922 step with the "STP" Command only when the unit is in the HOLD mode.

Table 5 below shows how to interpret the syntax. Note that each Data field is an ASCII decimal number representing a specific value for each parameter listed in the table. The abbreviation "W1" is "Wait for Channel 1 ACTUAL temperature."

A syntax example for a SETPOINT Step# 25, in File#7, SP1 at 255° and SP2 at 50% for 1 hour, 36 minutes, 58 seconds with EV1 ON and EV2 through EV8 OFF would be:

= <space> <STP> <space> <7> <space> <25> <space> <1> <space> <255>
 <space> <50> <space> <1> <space> <36> <space> <58> <space> <1>
 <space> <0> <space> <0> <space> <0> <space> <0> <space> <0> <space> <0>
 <0> <space> <0>.

Table 5 -
 "=STP" Command
 Data. ◊ = Non-
 literal Description.

	Step Type					
	SETPOINT	JUMLOOP	WAITFOR	AUTOSTART	STOP	LINK
File #	<File#>	<File#>	<File#>	<File#>	<File#>	<File#>
Step #	<Step#>	<Step#>	<Step#>	<Step#>	<Step#>	<Step#>
Type Code	1	2	3	4	5	6
Data.4	<SP1>*	<JS>	<W1>*	<DAY>*		<Link File#>
Data.5	<SP2>*	<JC>	<W2>*	<HOUR>*		
Data.6	<HOUR>*		<WHR>*	<MIN>*		
Data.7	<MIN>*		<WMN>*			
Data.8	<SEC>*		<WE>*			
Data.9	<EV1>*					
Data.10	<EV2>*					
Data.11	<EV3>*					
Data.12	<EV4>*					
Data.13	<EV5>*					
Data.14	<EV6>*					
Data.15	<EV7>*					
Data.16	<EV8>*					

* These commands can accept an asterisk to indicate that they are not programmed.

"? STP" Command

The "? STP" command reads a given step in the Series 922 program space (99 steps total). Data returned from the unit, that have a value of "*" (asterisk) mean that the value is unprogrammed.

The syntax for this command is:

?<Space> STP <Space> <File #> <Space> <Step #>

The command will return the following information:

<Step Type> <Space> Data.2 <Space> Data.3 ... Data.n

Table 6 below shows how to interpret the response syntax. Note that each argument is an ASCII decimal number representing a specific value for each parameter listed in the table.

A response for a Step# 8, in File#4 would be:

<1> <space> <235> <space> <50> <space> <1> <space> <20> <space> <15>
<space> <1> <space> <0> <space> <0> <space> <0> <space> <0> <space>
<0> <space> <0> <space> <0>

This tells you that Step# 8 in File#4 is a SETPOINT step, SP1 is 235° and SP2 is 50%. Step Time is 1:20:15, EV1 is ON and EV2 through EV8 are OFF.

In Table 6, the abbreviation "W1" is "Wait for ACTUAL temperature on Channel 1."

Table 6 -
"? STP" Command
Response Data.
< > = Non-literal
Description.

	Step Type					
	SETPOINT	JUMLOOP	WAITFOR	AUTOSTART	STOP	LINK
Type Code	1	2	3	4	5	6
Data.2	<SP1>*	<JS>	<W1>*	<DAY>*		<Link File#>
Data.3	<SP2>*	<JC>	<W2>*	<HOUR>*		
Data.4	<HOUR>*		<WHR>*	<MIN>*		
Data.5	<MIN>*		<WMN>*			
Data.6	<SEC>*		<WE>*			
Data.7	<EV1>*					
Data.8	<EV2>*					
Data.9	<EV3>*					
Data.10	<EV4>*					
Data.11	<EV5>*					
Data.12	<EV6>*					
Data.13	<EV7>*					
Data.14	<EV8>*					

* These commands can accept an asterisk to indicate that they are not programmed.

"?MTR"

"? MTR" Command

The ? MTR command monitors the current RUNNING or HOLDing step. Data returned from the unit, that have a value of "*" (asterisk) mean that the value is unprogrammed.

The syntax for this command is:

?<Space> MTR

There are no arguments to the command. The command will return the following data:

<File #> <Space> <Current Step #> <Space> <Current Step Type>
<Space> Data.4 <Space> Data.5 ... Data.n

Table 7 below shows how to interpret the response syntax. Note that each argument is an ASCII decimal number representing a specific value for each parameter listed in the table. A response would be:

<3> <space> <11> <space> <1> <space> <375> <space> <50> <space> <2>
<space> <30> <space> <0> <space> <1> <space> <1> <space> <1> <space>
<1> <space> <1> <space> <1> <space> <1> <space> <1>

This tells you that the current step is File#3, Step#11 a SETPOINT step, the SP1 is 375° and SP2 is 50%. Step Time is 2:30:00, EV1 through EV8 is ON.

Table 7 uses the following abbreviations:

W1 = ACTUAL waitfor temperature for Channel 1
W2 = ACTUAL waitfor temperature for Channel 2
WHR = Wait for hours programmed
WMN = Wait for minutes programmed
WRH = Wait for remaining hours
WRM = Wait for remaining minutes
WRS = Wait for remaining seconds
ADA = Autostart days accumulated
RH = Real time hours
RM = Real time minutes

Table 7 -
"? MTR" Command
Response Data.
<> = Non-literal
Description.

	Step Type					
	SETPOINT	JUMLOOP	WAITFOR	AUTOSTART	STOP	LINK
File #	<File#>	<File#>	<File#>	<File#>	<File#>	<File#>
Step #	<Step#>	<Step#>	<Step#>	<Step#>	<Step#>	<Step#>
Type Code	1	2	3	4	5	6
Data.4	<SP1>	<JS>	<W1>*	<DAY>*		<Link File#>
Data.5	<SP2>	<JC>	<W2>*	<HOUR>*		
Data.6	<HOUR>		<WE>*	<MIN>*		
Data.7	<MIN>		<WHR>*	<ADA>		
Data.8	<SEC>		<WMN>*	<RH>		
Data.9	<EV1>		<WRH>	<RM>		
Data.10	<EV2>		<WRM>			
Data.11	<EV3>		<WRS>			
Data.12	<EV4>		<EI>			
Data.13	<EV5>					
Data.14	<EV6>					
Data.15	<EV7>					
Data.16	<EV8>					

*These commands can accept an asterisk to indicate that they are not programmed.

"? AFL" Command

This command asks the Series 922 for the file numbers of files that are programmed.

The syntax for the command (not including protocol characters) is:
?<Space> AFL

The command will return the following data in ASCII numbers:

Data.1 <Space> Data.2 <Space> Data.3 <Space> ... Data.n

Data.1 will always be 1, i.e., File #1. File #1 will always appear, even with a cold-started unit when that file is defaulted to a one step STOP step program. Data.2 through Data.n are the file numbers of the other programmed files.

"= TI" Command

The "= TI" Command is used to set the Series 922 real time clock in hours, minutes, and seconds.

The syntax for this command (not including protocol characters) is:
= <Space> TI <space> <Data.1> <space> <Data.2> <space> <Data.3>

The arguments, in ASCII numbers, must always be:

Data.1 = Real time hours, range, 0 to 23.

Data.2 = Real time minutes, range, 0 to 59.

Data.3 = Real time seconds, range, 0 to 59.

The "= TI" Command can only be used when the unit is in the HOLD mode.



NOTE:

You may write to the Series 922 real time clock with the "= TI" Command only when the unit is in the HOLD mode.

"? TI" Command

The "? TI" command asks Series 922 real time clock for its hours, minutes, and seconds.

The syntax for this command (not including protocol characters) is:
?<Space> TI

The command will return the following data :

<Data.1> <space> <Data.2> <space> <Data.3>

The arguments, in ASCII numbers, will always be:

Data.1 = Real time hours, range, 0 to 23.

Data.2 = Real time minutes, range, 0 to 59.

Data.3 = Real time seconds, range, 0 to 59.

"= CLRf" Command

The "= CLRf" command clears a given file# from 1 to 10 in the Series 922 program space (99 steps total). This command can only be performed in the HOLD mode.

The syntax of the command (not including protocol characters) is:
= <Space> CLRf <Space> <File # >

This command will not return an error message even though the file number may not exist.

NAKs and Error Codes

When your message is "not acknowledged" (NAK) in RS-422A with ANSI X3.28 Protocol, you may clear the ER2 code by reading it. That is, use the "?" Command to query the ER2 parameter, or scroll at the Series922 front panel in the SYSTEM menu to "ER2", and press the ENTER key.

Then try the message again; you may have made a syntax error. See the error code listing in Table 3, Pages 15 - 16.

With XON/XOFF protocol and the RS-423A interface, the 922 sends no feedback on commands. Therefore, you may want to query the status of ER 2 after each command you send.

All communications-related error codes are ER2 error codes, that is they are not considered cause for a shutdown of the 922 unit itself. There is always a communications error code generated when a <NAK> character is sent under the ANSI X3.28. With XON/XOFF flow control error codes may be generated, but there will be no standard indication of this fact.

That's All There Is To It

The best way to become really familiar with data communications is to use it. Use this manual in conjunction with the Series 922 User's Manual, and "Introduction to Data Communications with WATLOW Controls."

A

Asterisk "*", 7, 20, 21, 22
 ADA, 22
 AFL, 15
 AFL Command, 23
 ALM, 15
 ANLG, 18
 ANSI X3.28 "=" Command Example, Fig. 6, 13
 ANSI X3.28 "?" Command Example, Fig. 7, 14
 ANSI X3.28 Protocol, 3, 12
 ASCII and Series 922 Information, 5
 ASCII Character Set, Table 1, 6
 ASCII Control Characters (Partial Set), Table 2, 6
 AT1, 17
 AT2, 17
 AUX1, 15
 AUX2, 15
 AXH, 17
 AXL, 17

B

Baud Rate, 5

C

C1, 15
 C2, 15
 CALX, 17
 Carriage Return, 9
 CFU, 17
 CLRF, 18
 CLRF, = Command, 24
 Command, "?", 16
 Command, "=", 16
 Command Data & Responses, Partial Set for "?", Table 4, 15
 Command Data "=" and "?", Table 4, 17
 Command List, 8
 Communications Software, 5
 Communications Wiring, 3
 Connecting the Control and the Computer, 5
 Contents, 2
 CTXC, 17
 CTXH, 17

D

Data Bits, 5
 Data Link Escape (DLE), 13
 Data Rules, 7
 DBX, 17
 Device Address, 12
 DIP, 15

E

EI, 15
 End of Text (ETX), 9
 ER1, 16
 ER2, 16
 EV1, 18
 EV2, 18
 EV3, 18
 EV4, 18
 EV5, 18
 EV6, 18
 EV7, 18
 EV8, 18
 Example Format, 8

F

Flow Control, 9
 FST, 15
 FST, "?" Command, 19

G

GS, 18

H

HOLD, 18
 HOLD Command, 19
 How to Start and Stop Communicating with the Series 922 and XON/XOFF, 9
 How to Use Data Communications with the Watlow Series 922, 3

I

Identification Number, 12
 IN, 15
 Index, 25
 Interface Pinouts,
 RS-422A, Fig. 1, 4
 RS-423A, Fig. 2, 4

K

KEY, 15

L

LAT, 18
 LOCK, 18

Index

M

MDL, 15
Message Syntax, 7
MTR, 15
MTR, "?" Command, 22
MTR, "?" command Response Data, Table 7, 22
Multidrop, 3

N

NAKs and Error Codes, 24
Network connections, 4

O

Other ? or = Commands, 19
OUTX, 15

P

Parity, 5
PBXC, 17
PBXH, 17
Protocol,
 RS-423A, 9
 ANSI X3.28, 12, 13

R

RBXC, 17
RBXH, 17
RH, 22
RM, 22
RS-422A, 3, 4
RS-422A Interface Pinouts, Fig. 1, 4
RS-423A, 3, 4
RS-423A Interface Pinouts (RS-232C Compatible)
 Fig. 2, 4
RSUM, 18
RSUM, "=" Command, 19
RSXC, 17
RSXH, 17
RTXC, 17
RTXH, 17
RUN, 15
RXH, 17
RXL, 17

S

SCAL, 18
Series 922 Communication Parameters, 5
Series 922 General Message Syntax, 7
Series 922 General Message Syntax
 Example, Fig. 3, 8
SPX, 18
Space, 8
Start Bits, 5
Starting Communications in ANSI X3.28 Protocol, 12
Start of Text (STX), 9
Stop Bits, 5
Stopping Communications in ANSI X3.28 Protocol, 13
STP, 15
STP, "=" Command, 20
STP, "?" Command Data, 21
STP, "?" Command Data Response, Table 6, 21
STP Command Data, Table 5, 20
STRT, 18
STRT, "=" Command, 19

T

That's All There is To It, 24
TI, 15
TI, "=" Command, 23
TI, "?" Command, 23
Two Serial Hardware Interfaces and Two Software
 Protocols, 3
TYP, 15

W

W1, 22
W2, 22
Watlow Controls, 27
WHR, 22
Wiring Data Communications, 4
WMN, 22
WRH, 22
WRM, 22
WRS, 22

X

XON/XOFF "=" Command Example, Fig. 4, 10
XON/XOFF "?" Command Example, Fig. 5, 11
XON/XOFF Protocol for RS-423A, 9
XON/XOFF Protocol, 3

Watlow Controls

Watlow Controls is a division of Watlow Electric Manufacturing Company of St. Louis, Missouri. Watlow is an established manufacturer of industrial electric heating products, in business since 1922. Watlow boasts the ability to begin with a full set of specifications and to complete an industrial product that is manufactured totally in-house, in the U.S.A. Products designed and manufactured by Watlow are electric heating elements, sensors, electronic temperature controls and power switching devices.

The Winona operation has been designing solid state electronic control devices since 1962, and has earned the reputation as an excellent supplier to original equipment manufacturers. These OEMs depend upon Watlow Winona to provide compatibly engineered controls which they can incorporate into their products with confidence.

Watlow Controls resides in a new 100,000 square foot marketing, engineering and manufacturing facility in Winona, Minnesota.